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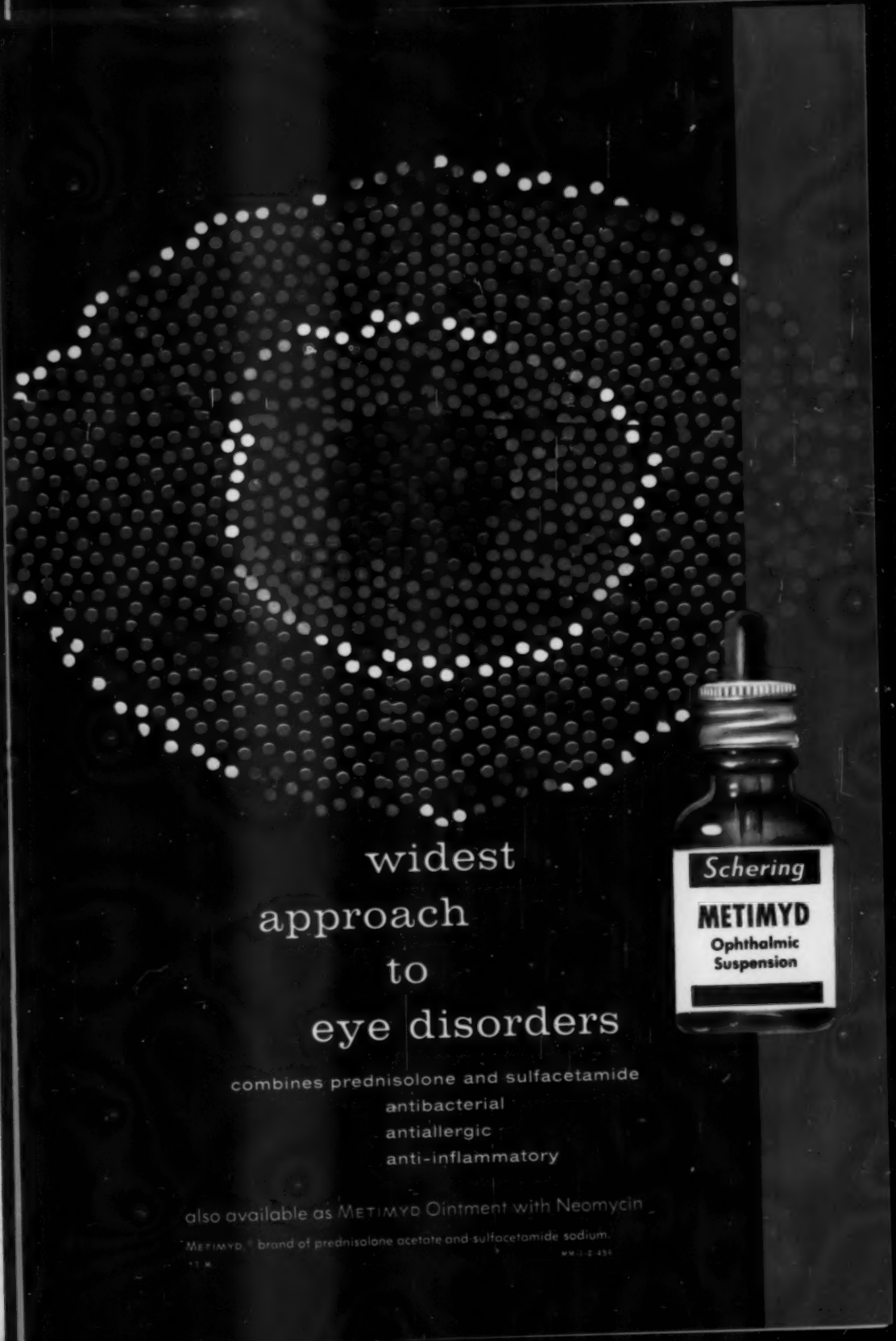
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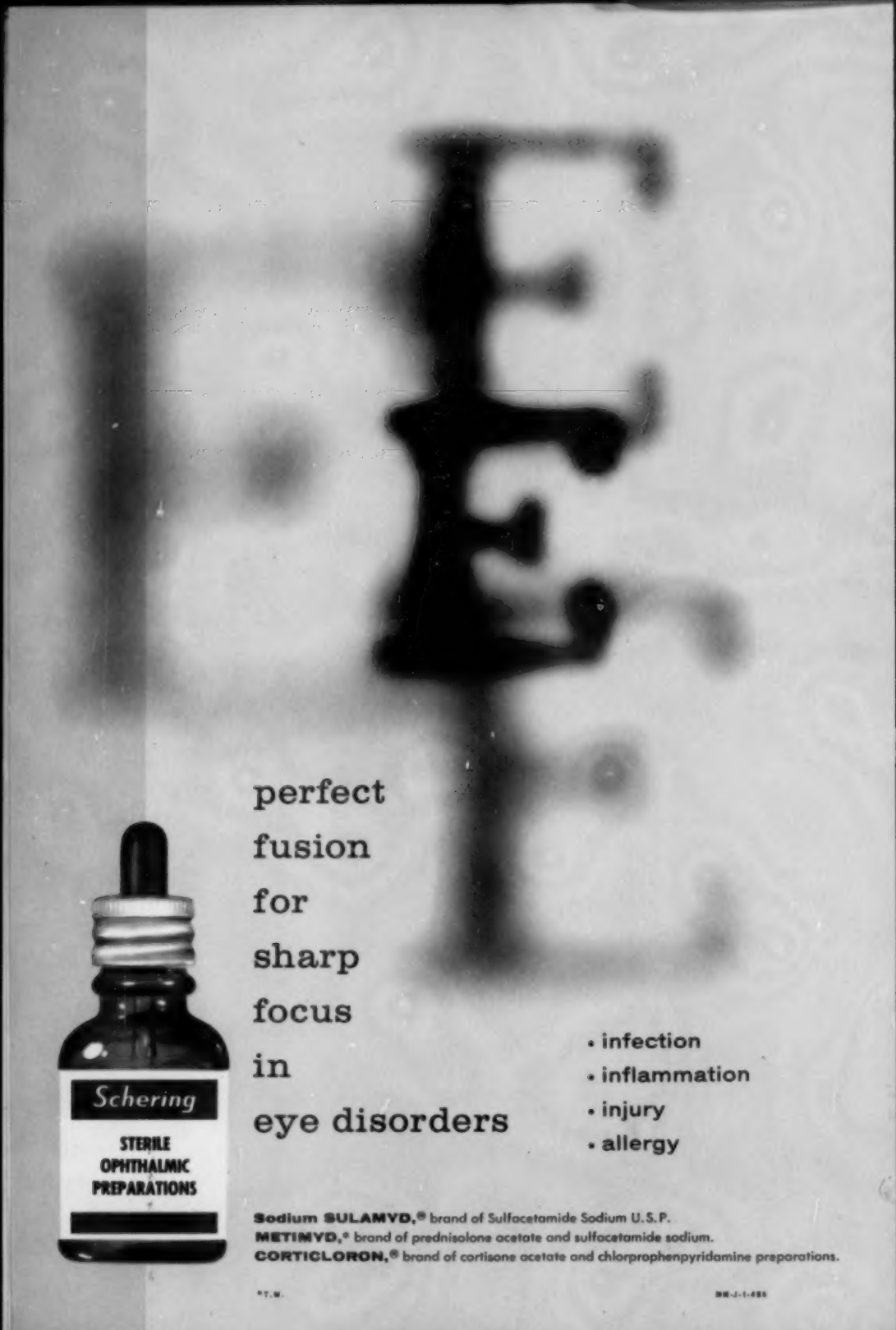
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AMERICAN JOURNAL OF OPHTHALMOLOGY

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PRIMARY DEGENERATION IN THE VICINITY OF THE CHAMBER ANGLE*

AS AN ETIOLOGIC FACTOR IN WIDE-ANGLE GLAUCOMA: PART II

C. C. TENG, M.D., H. M. KATZIN, M.D., AND H. H. CHI, M.D.
New York

In our first report on primary degeneration in the vicinity of the anterior chamber angle[1] we noted that it is often found in eyes that were apparently normal. We described in detail three cases with more extensive changes of the same type. These eyes were from patients with known open-angle glaucoma. A fourth case of this type was obtained through the kindness of Dr. Wendell Hughes, and has been studied.

Examination of these two eyes demonstrated once more that this type of degeneration can cause obstruction of the outflow of the aqueous, which becomes manifest as glaucoma when the obstruction is extensive enough. Qualitatively speaking, from the serial section reconstruction study of a total of four cases, we can conclude that this degeneration is at least one important etiologic factor in open-angle glaucoma.

This case report serves to confirm our previous findings and to present some new points in the orientation and interpretation of the pathology.

HISTORY OF THE CASE
(Dr. Wendell Hughes)

The patient was a 59-year-old married woman whose father and mother both had a history of glaucoma. At the age of 37 years she had pain in the left eye off and on for four months. Her vision was 20/20, O.D., and 20/25, O.S., and intraocular pressure was 28 mm. Hg (Schiøtz), O.D., and 26 mm. Hg, O.S. She was placed on one-percent pilocarpine three times a day in each eye. The pressure rose to 30 mm. Hg in each eye two months later and pilocarpine was increased to four times a day. One year later the pressure was maintained at 25 mm. Hg in each eye, and vision was 20/20 in each eye with correction.

Three years later her vision was recorded at 20/15 in each eye; intraocular pressure was 26 mm. Hg, O.D., and 30 mm. Hg, O.S. Pilocarpine was then changed to three times a day. Three months later tension was 23 mm. Hg in each eye and pilocarpine was changed to twice a day.

In 1944, 11 years from her first treatment, vision was 20/15 in each eye with correction and intraocular pressure was 23 mm. Hg in each eye. The patient was maintained on pilocarpine.

Intraocular pressure was the same in 1945 and in 1947, her last visits to the ophthalmologist. The fundus views were entirely normal.

The patient died on April 30, 1955, due to cancer within the abdomen with metastasis into the brain, and the eyes were donated to the Eye-Bank.

PATHOLOGY

The globes were entirely normal in size and general appearance, except for the drainage system at the chamber angle and the region of the optic disc.

There was primary degeneration in the

* From the laboratory of The Eye Bank for Sight Restoration, Inc., Manhattan Eye, Ear, and Throat Hospital, aided by Grant B 153 from the U. S. Public Health Service and by the Josiah Macy, Jr., Foundation.

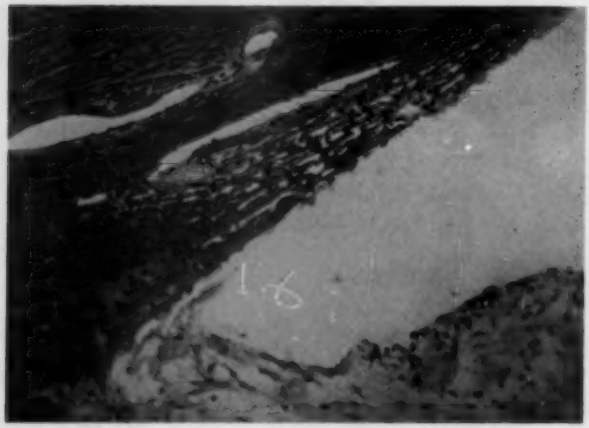


Fig. 1 (Teng, Katzin, and Chi). E.B., 3,909, O.D., slide 295, hematoxylin-eosin. This picture is from the upper part of Schlemm's canal. There is a very small area of degeneration at the tip of Schlemm's canal. Otherwise, it is normal.

wall of the chamber angle. The picture was very much the same as we described in our first report. The degeneration was found mostly in the external portion of the trabecula. It spread either externally or internally to Schlemm's canal, the collector channels, and even to the intrascleral plexus. The walls of these channels and their adjacent tissue were found to be destroyed in many places.

Collagen degeneration was demonstrated by loss of its staining property with every stain used in our study—hematoxylin-eosin, van Gieson, Verhoeff, and periodic acid-Schiff. The collagen fibers often showed a breaking down into granules and, in advanced lesions, eventual disappearance. In many places they were replaced by proliferated endothelial cells, which had an edematous or spongy appearance. The elastic fibers were more resistant than collagen to this degenerative process. In many areas where collagen had degenerated the elastic fibers still appeared intact as multiple fine granules or fibers. In areas of more advanced degeneration they had decreased in number or disappeared entirely.

The changes observed were proliferation of the endothelium as well as a strong tendency toward adhesion between the trabecular spaces, the walls of Schlemm's canal, and the walls of the collector channels. By these processes many passages were obliterated.

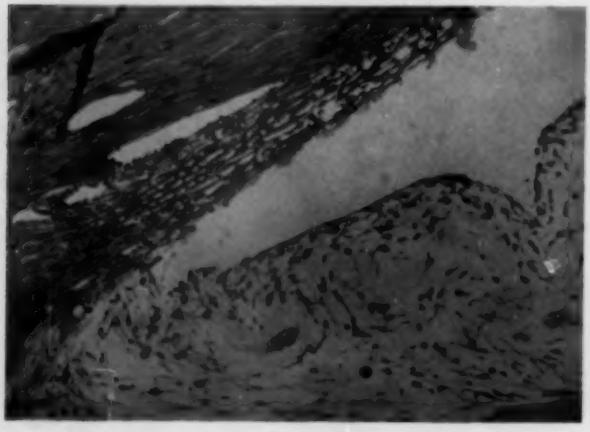
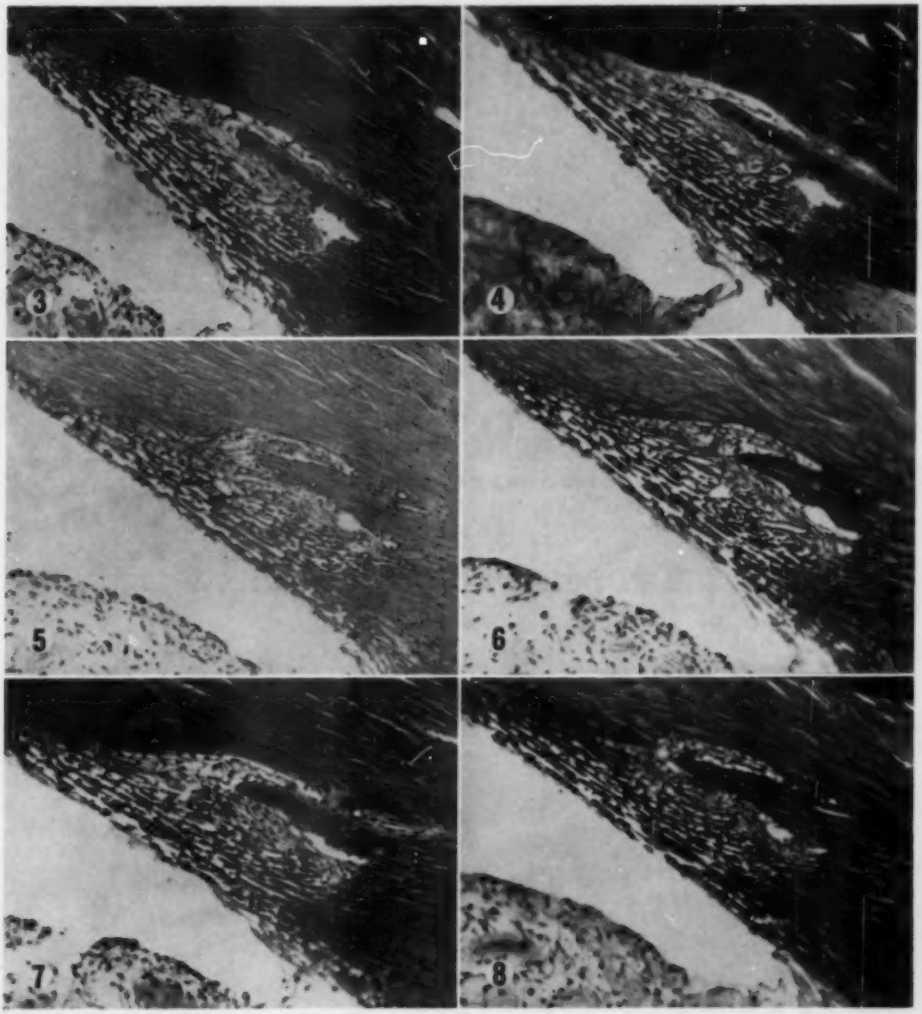


Fig. 2 (Teng, Katzin, and Chi). E.B., 3,910, O.S., slide 295, hematoxylin-eosin. This photograph was taken from the upper part of Schlemm's canal. It is within the normal limit.

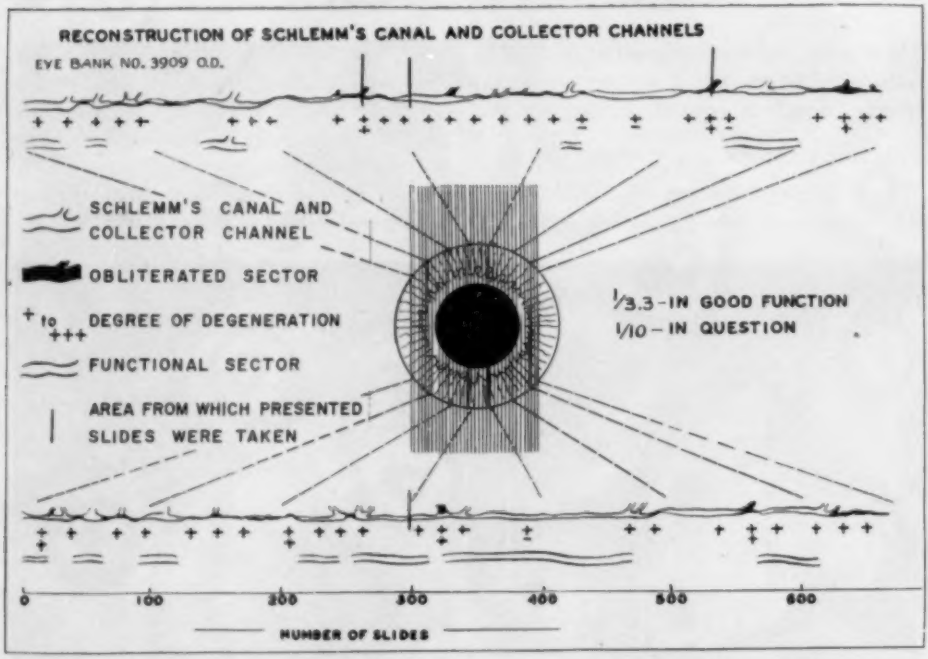
There were signs of recanalization in the collector channels, but it did not seem extensive enough to re-establish the outflow.

Partial reconstruction of the system

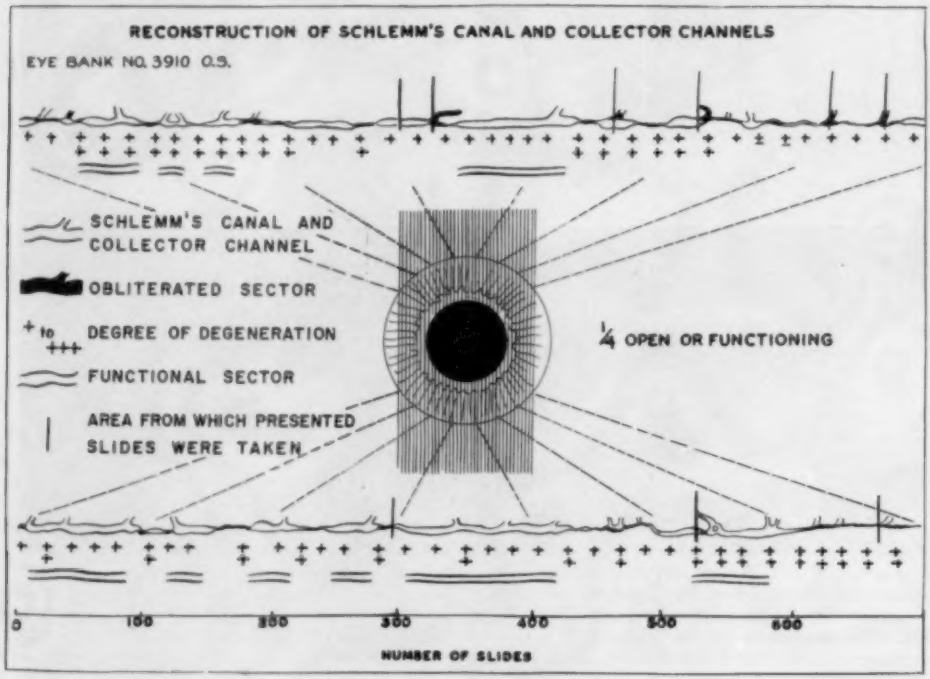
In evaluating the degree of obstruction of the drainage system, it is impossible to depend on the evidence furnished by a few random slides. One might very well read a few slides in a normal area (figs. 1 and 2) and make a diagnosis of "normal eye." The real pathologic process would be missed. By reading all the consecutive serial sections and reconstructing Schlemm's canal and the



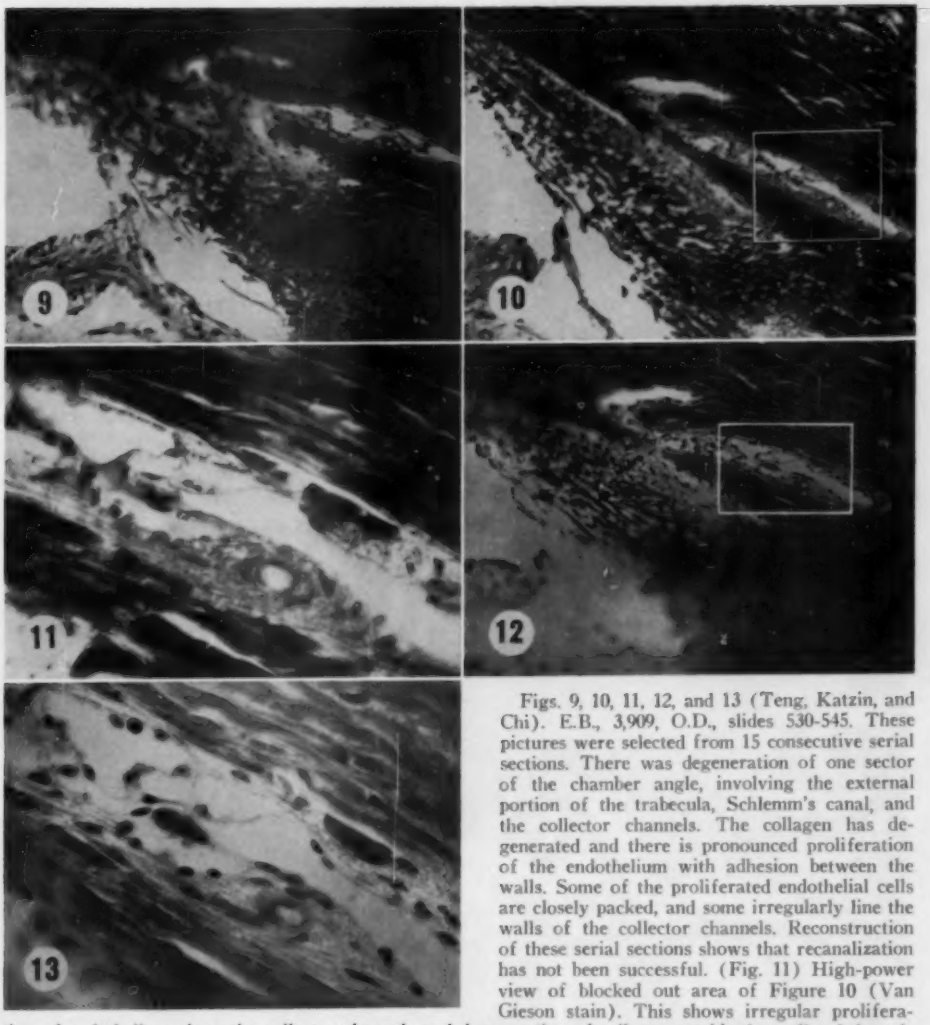
Figs. 3, 4, 5, 6, 7, and 8 (Teng, Katzin, and Chi). E.B., 3,909, O.D. Figs. 3 and 7, hematoxylin-eosin; fig. 4, Van Gieson; fig. 5, periodic acid-fuchsin; figs. 6 and 8, Verhoeff. These six slides are selected from 30 consecutive serial sections (slides 255-285) to show the obliteration of Schlemm's canal and the collector channels by the degenerative process and proliferation of endothelium. In the region of the collector channels the change seems to be limited to the inside of the canal and there is slight degeneration of the surrounding collagen.



Graph 1



Graph 2

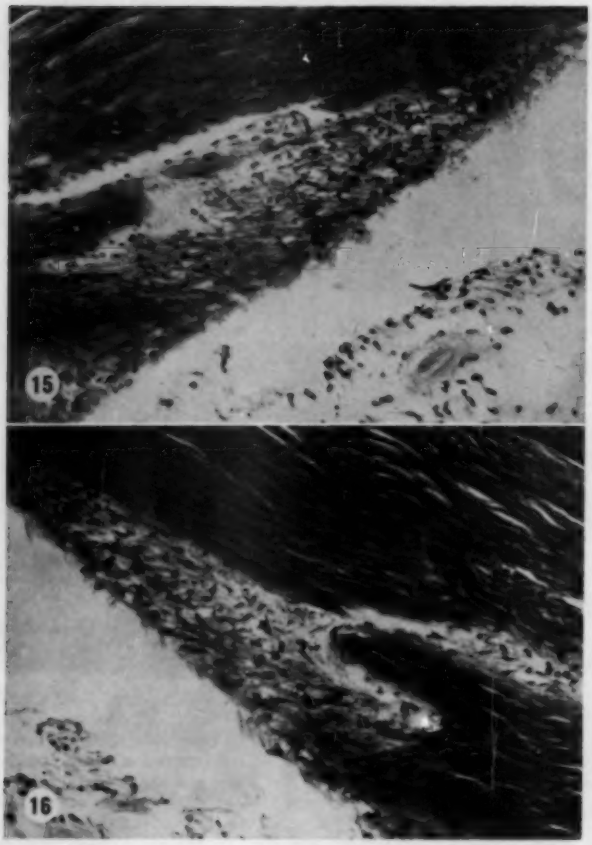


Figs. 9, 10, 11, 12, and 13 (Teng, Katzin, and Chi). E.B., 3,909, O.D., slides 530-545. These pictures were selected from 15 consecutive serial sections. There was degeneration of one sector of the chamber angle, involving the external portion of the trabecula, Schlemm's canal, and the collector channels. The collagen has degenerated and there is pronounced proliferation of the endothelium with adhesion between the walls. Some of the proliferated endothelial cells are closely packed, and some irregularly line the walls of the collector channels. Reconstruction of these serial sections shows that recanalization has not been successful. (Fig. 11) High-power view of blocked out area of Figure 10 (Van Gieson stain). This shows irregular proliferation of endothelium along the collector channels and degeneration of collagen outside the walls of the collector channels. The fine, regular granules are the persistent elastic fibers. The wall of the arteriole also shows collagen degeneration. Normally it should stain as darkly as the scleral tissue. (Fig. 13) High-power view of blocked out area of Figure 12. (Hematoxylin-eosin.) This shows the pattern of endothelial proliferation.

←

Graphs 1 and 2 (Teng, Katzin, and Chi). Graphs 1 and 2 represent the reconstruction of Schlemm's canal and the collector channels in two eyes. They are based on a study of consecutive serial sections from which we estimated the degree of obstruction of the channels.

About 65 percent of the length of Schlemm's canal was examined in the right eye and about 70 percent in the left eye. Judging from these sections and the degree of obstruction they exhibited, we believe that the portion of the drainage system still functioning was slightly more than one third in the right eye and about one fourth in the left eye.



Figs. 15 and 16 (Teng, Katzin, and Chi). O.S., E.B., 3,910, slide 655, hematoxylin-eosin stain. In this sector both sides of the chamber angle show degeneration, causing complete obliteration of Schlemm's canal and part of the collector channels.

collector channels, we may obtain a much more complete picture. Graphs 1 and 2 are charts representing the reconstruction of Schlemm's canal and the collector channels of these two eyes.

Iris blockage of the chamber angle

Usually in old cases of open-angle glaucoma there are anterior peripheral synechias. In these two eyes there were very few synechias. There were several areas with adhesions, but none of them extended beyond one-third the width of the trabecula, so there was no danger of obstruction to the outflow of aqueous from this cause.

Obstruction at the trabecular meshwork

The causes of obstruction in the trabeculas, as described in our previous report, were, first, degeneration and adhesion between the trabeculas; second, loss of collagen support, causing the collapse of the meshwork; third, the edematous condition of the tissues; and, fourth, proliferation of the endothelium and consequent blocking of the intratrabecular spaces.

In this case the trabecular fibers were slightly thickened, as they usually are, due to senile sclerosis. It was not marked, and the trabecular spaces were normal. Degen-

erative changes in this region were limited to the outer portion of the trabecula. These changes, however, were present over a wide area. It is very hard to evaluate the actual degree of obstruction in this location from histologic evidence alone, because the meshwork is very porous.

Obstruction of Schlemm's canal

As we have demonstrated in all four reported cases, Schlemm's canal is the most important drainage area for obstruction.

In the evaluation of the degree of obstruction in Schlemm's canal, if an area has a complete adhesion or blockage, it renders that whole sector nonfunctional, even if the collector channel is patent. An example of this is the area marked 350-400 in the upper portion of the right eye and 620-660 in the lower portion of the left eye (graphs 1 and 2).

In area 445-510 of the upper portion of the right eye and 200-260 in the upper portion of the left eye, another condition is seen. Here the canal is completely blocked by solid adhesions in two locations. Between them, the canal appears to be normal. Since there is no collector channel draining the normal part of the canal, however, the whole section is not functioning.

Obstruction in the collector channels

Obstruction at the site of the collector channels is the second most important factor in decreasing the facility of the outflow of aqueous. There are only 20 to 30 of these exit channels along the whole course of Schlemm's canal. To evaluate the degree

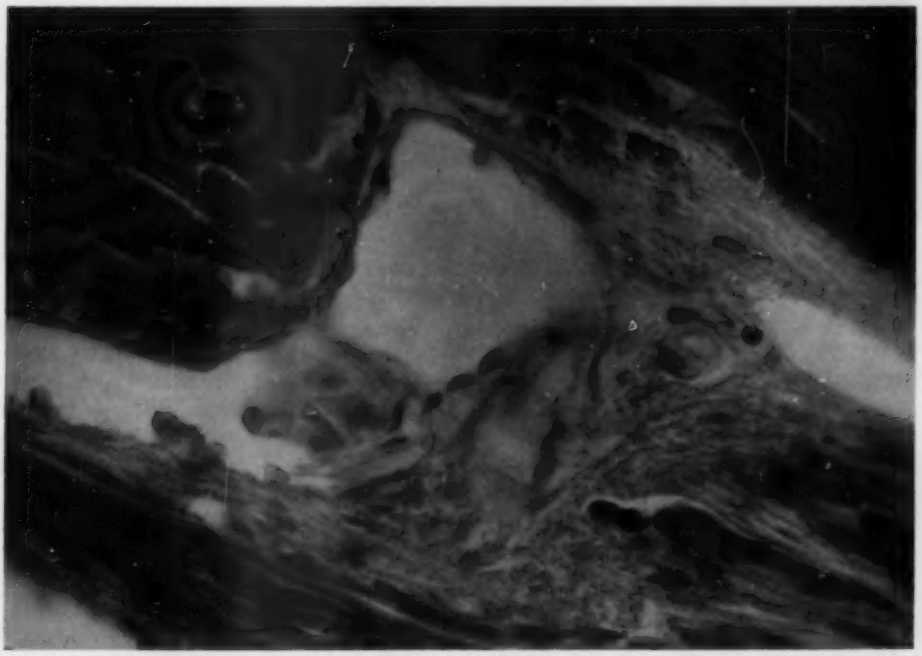
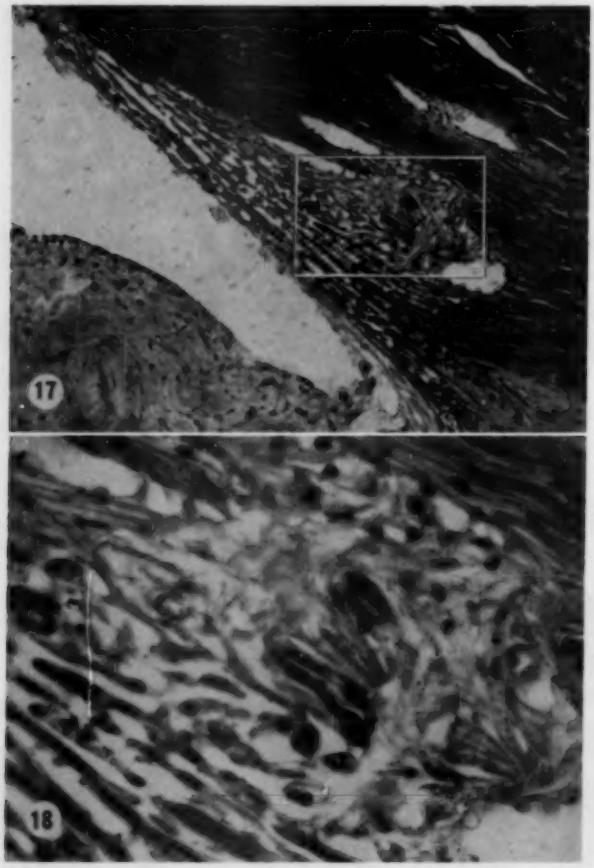


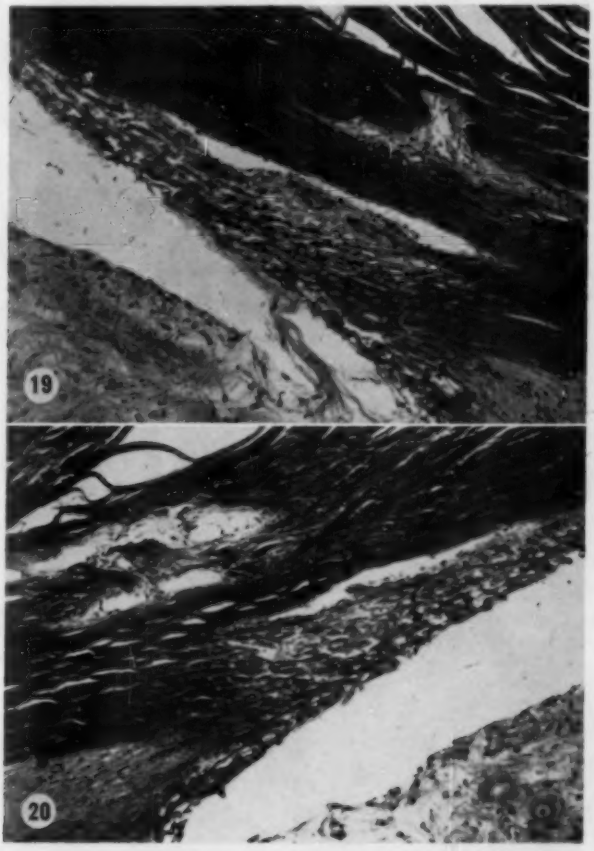
Fig. 14 (Teng, Katzin, and Chi). E.B., 3,910, O.S., Van Gieson stain slide 455, high-power view. Degeneration of collagen found outside the wall of the collector channels, with gradual loss of staining property. The collagen also exhibits a breaking down into patches or coarse granules. The fine, regular granules are the intact elastic fibers, which are more resistant to degeneration.



Figs. 17 and 18 (Teng, Katzin, and Chi). (Fig. 18) High-power view, O.S., E.B., 3,910, slide 345, Van Gieson. Degenerative loss of collagen outside of Schlemm's canal and the collector channels. The space is filled by edematous, proliferated endothelium partially obliterating the channel.

of obstruction, one must correlate the collector channels with the condition of Schlemm's canal. Complete obstruction of a few collector channels alone will not produce glaucoma, because aqueous can be drained through the patent ones. If a collector channel is blocked and the corresponding sector of Schlemm's canal is obstructed on both sides, as in Graph 1, in the upper portion between 280-340, and Graph 2, in the upper portion between 430-483, the effect is obvious. In pathologic cases, both the collector channels and Schlemm's canal are usually involved by the degenerative process in that area.

There was involvement of the intrascleral plexus also in our case (figs. 19 and 20). Since there is free anastomosis in this area, we cannot judge the actual degree of obstruction. Using our methods we could not reconstruct this part, as Theobald[2] did, because our sections were thinner and there was too much distortion, particularly in the specially stained specimens. These are not good for reconstruction purposes using Theobald's method. However, judging from the reconstruction of Schlemm's canal and the collector channels by our method, we obtained a good idea of the degree of obstruction of the whole drainage system.



Figs. 19 and 20 (Teng, Katzin, and Chi). O.S., E.B., 3,910, slide 525, Van Gieson. There is degeneration in the region of the intrascleral plexus on both sides of the chamber angle. Schlemm's canal and the trabeculas are little involved.

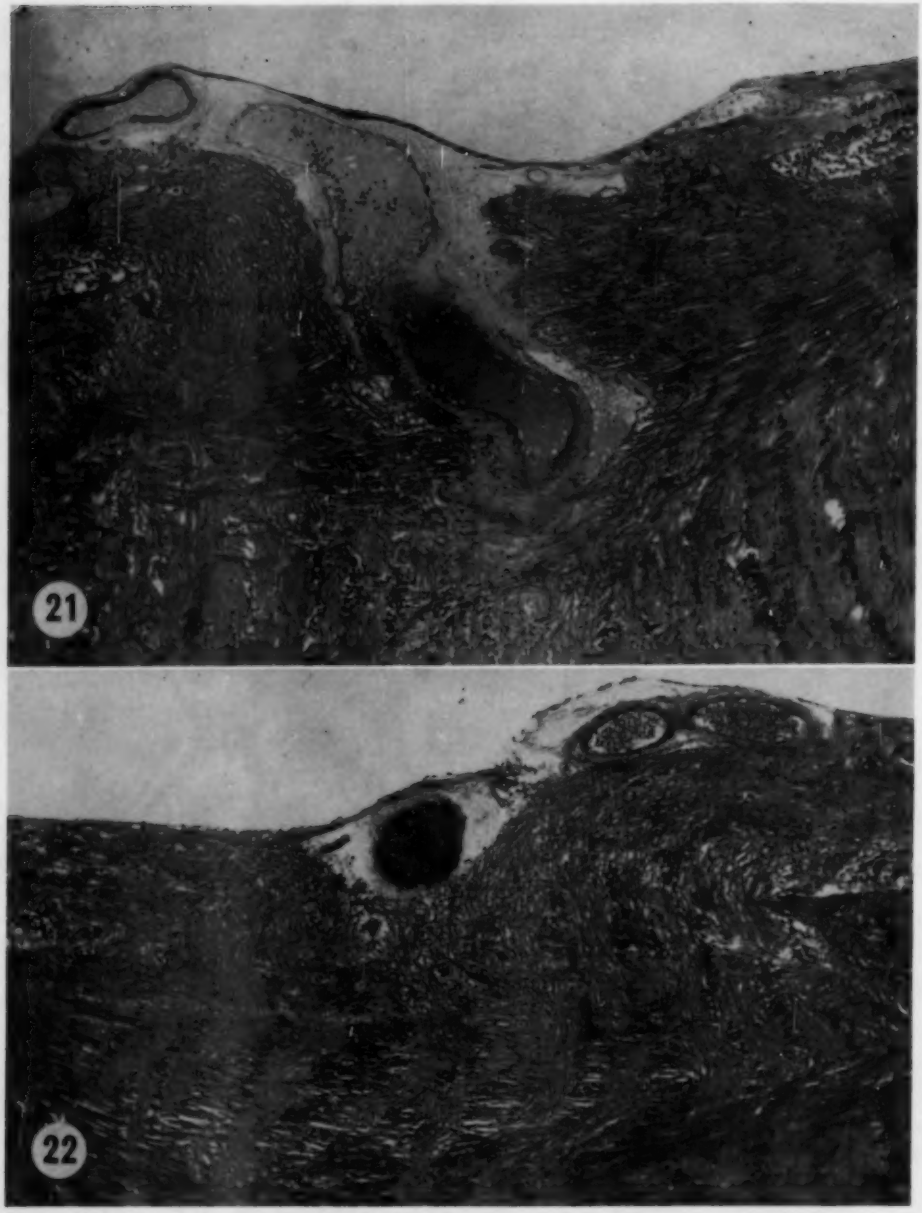
Discussion

This additional case confirmed our earlier findings and strengthened our view that more research on this subject would be fruitful. A real evaluation of the importance of this type of degeneration in causing the obstructive type of glaucoma depends on the histologic analysis of a greater number of cases and careful co-ordination with clinical findings. There is a need for co-ordination between the clinician and the pathologist. This report is one example of this kind of co-operation. An accurate and complete history is required. Findings should include the original tension or tonography, gonioscopy, fundus examinations, and visual fields. Even very small bits of tissue from the eye should be saved for pathologic study. In the present study every available section in the area of the drainage system had to be studied and reconstructed in order to evaluate the degree of obstruction to the aqueous outflow.

We also need new and better histologic techniques, especially in the study of endothelium and the glass or basement membrane of the trabecula.

Conclusion

The analysis of this case adds nothing new to the picture as first reported. It does, however, present some further interpretations of our findings.



Figs. 21 and 22 (Teng, Katzin and Chi). The optic nerveheads in the right and left eyes are both essentially normal, except for some perivascular pallor. This type of degeneration in the region of the optic nervehead will be reported later.

The pathologic picture may be divided into two phases; one is the degenerative, the other is the healing or tissue reactive phase. The degenerative phase probably starts with the protective endothelial lining of the trabecula around Schlemm's canal. The collagen becomes hydrated and loses its staining property. The collagen fibers gradually break down, disintegrate, and disappear. The elastic fibers also yield to the degenerative process, but much more slowly. Lesions often show loss of elastic fibers. In some cases there may be an apparent increase of elastic fibers. This is probably because after the degeneration and disappearance of the collagen fibers, the intact elastic fibers draw together and become more compact.

The healing or reactive phase of the degeneration is marked by proliferation of endothelium. In early stages the endothelium is swollen, edematous, and spongy, forming adhesions between surfaces and walls. Later the affected area is covered by proliferated endothelium, so that the underlying tissues are protected, and the excessive hydration of this part of the tissue ceases. Then the tissue becomes dehydrated and compact in form, and the endothelium may resemble laminated fibrous tissue. There seems to be no new deposition of collagen and the characteristic lack of staining property remains. Both the degenerative and proliferative phases contribute to the decreased facility of aqueous outflow. Occasionally, however, the healing phase is accompanied by signs of recanalization. The proliferated endothelial cells may line up in a more or less regular manner after the fashion of a new capillary, but there is no sign of restoration of function.

210 East 64th Street (21).

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EPIPHORA*

II. Its relation to the anatomic structures and surgery of the medial canthal region

Lester T. Jones, M.D.
Portland, Oregon

Cure of epiphora is dependent on a knowledge of the structures of the medial canthal region. And good results in handling problems of the lacrimal drainage system will be in direct proportion to an understanding of its mechanism. The anatomic relationships of this area are intricate, and misconceptions of some of the structures have crept into our textbooks.

In a preliminary paper[1] on "Epiphora: Its causes and new surgical procedures for its cure," I made several observations on what were termed the "lacrimal diaphragm" and the "lacrimal pump." Further dissections and study make it necessary to clarify and revise parts of that report and to give further results on clinical experience.

Anatomic structures

The medial canthal region is, roughly, a pyramidal section, the apex of which is

* The presidential address presented before the Pacific Coast Oto-Ophthalmological Society, April, 1956.

formed by the puncta (lids closed) and the base by the lacrimal fossa and adjacent bony margins. Its upper and lower borders are the imaginary lines which divide the ciliary part of each lid (lateral five sixths) from the lacrimal part (medial one sixth). The anterior and posterior surfaces are the cutaneous and conjunctival sides, respectively. Within this section is contained all of the lacrimal drainage apparatus except the nasolacrimal duct. The following descriptions are based on observations made of 10 orbital dissections in the Department of Anatomy, University of Oregon Medical School.

Medial palpebral ligament

This is essentially a thickening of the periosteum. Its margins therefore are not all exact. It begins anteriorly near the nasomaxillary fissure and broadens as it passes laterally to the upper part of the anterior lacrimal crest where it turns posteriorly to end at the posterior lacrimal crest. It thus has an anterior part and a posterior part. The anterior surface of the anterior part is smooth, being covered medially by the angular head of the quadratus labii superioris muscle and the angular vein and artery. The rest is covered only by skin.† Further description of the posterior part will be made under "lacrimal diaphragm." Muscle origins from each part of the ligament will be given under "muscles."

Most textbooks[3] describe the medial palpebral ligament as extending from the medial canthus to the tarsus of each lid. My dissections fail to show this either grossly or microscopically. If a ligament were present it would have to pass through one head of the palpebral muscle even to reach the tarsus. The confusion has probably been caused by the resemblance to ligament of the common tendon of the superficial part of the palpebral muscle. The so-called "lower free border of the ligament"[4] is the part which is easily and clearly identified in approaching this region at operation. However, it always becomes muscle medial to the puncta. Interestingly, the old terminology, "tendo oculi,"[5] is more accurately descriptive of this part than the present terminology.

Lacrimal diaphragm

This consists of the extension of the periorbita covering the lacrimal fossa, known as the lateral lacrimal fascia, which is joined in its upper half by the posterior part of the medial palpebral ligament. The lacrimal diaphragm is not only continuous with the periorbita at the margins of the lacrimal fossa, but it is also continuous with the periosteal layer that passes medial to the sac and completely invests it. The diaphragm appears to be thinnest just below the junction of the anterior and posterior portions of the medial palpebral ligament. This would account for perforations that accompany acute dacryocystitis pointing here.

Below the level of the posterior part of the medial palpebral ligament, the diaphragm is covered by, or gives rise to the septum orbitale. This part of the septum orbitale attaches to or, rather, is a continuation of the medial ends of the two tarsi. It covers the lateral surface of the deep heads of the palpebral muscle and protects the orbital cavity from extensions of infection from perforations of the sac. Thus, the lacrimal diaphragm converts the lacrimal fossa into a completely closed cavity except where blood vessels and ducts enter or leave it. It becomes a sac enveloping a sac. A medial movement of the diaphragm creates a positive pressure in the sac and a lateral movement creates a negative pressure.

Muscles

Whitnall[4] described the orbicularis oculi as being divided into two main parts—orbital and palpebral. This paper is concerned primarily with the palpebral part which is sub-

† In my preliminary paper[1] the posterior part of the medial palpebral ligament was referred to as the "reflex" part. Wolff[2] called this the "posterior portion," which fits our present conception better than the term "reflex."

Fig. 1 (Jones). *Main subdivisions of the palpebral muscle.* (a and a′) Upper and lower pretarsal muscle. (b and b′) Upper and lower preseptal muscle. (c and c′) Orbital part of orbicularis oculi muscle. The dotted lines enclose the anterior surface of the "lacrimal pyramid."

divided into pretarsal and preseptal. The pretarsal part lies on the anterior surface of each tarsus, the upper being roughly delimited above by the superior palpebral skin fold and the lower by the inferior palpebral skin fold. The preseptal part lies on the septum orbitale between the pretarsal and the bony orbital margin in the upper and lower lids.

The origins of these muscles are at the medial canthus and each has two heads, a superficial and a deep. Each pretarsal muscle is formed by the junction of Horner's muscle (deep head)* with the superficial head† from the medial palpebral ligament. Each preseptal muscle is formed by the junction of a previously undescribed muscle (deep head), which arises from the lacrimal diaphragm, with the superficial head from the medial palpebral ligament.

The anterior part of the medial palpebral ligament gives origin to all the *superficial* heads of the orbicularis oculi. They are arranged in a fanlike series as follows: (1) From the upper margin are (a) the orbital-corrugator-supercilii and (b) the superior preseptal muscle; (2) laterally, from its junction with the posterior part of the ligament, is the common tendon of the two pretarsal muscles; (3) from the lower border are (a) the lower preseptal, (b) some of the orbital part of the orbicularis oculi, and (c) usually a few fibers of the angular head of the quadratus labii superioris muscles.

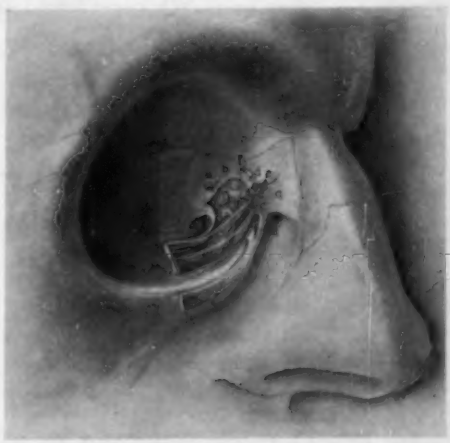

Fig. 2 (Jones). *Muscle origins from medial canthal region.* (a) Upper and lower deep heads of pretarsal muscles (Horner's muscle). (b) Upper and lower deep heads of preseptal muscles. (c) Upper and lower superficial heads of pretarsal muscles. (d) Upper and lower superficial heads of preseptal muscles. (e and f) Superficial and deep heads of composite corrigator-orbital muscle. (e′) Anterior part of medial palpebral ligament. (g) Junction of canaliculi.

* Also known as tensor tarsi (Duverney, 1749), posterior lacrimal, and pars lacrimalis of orbicularis oculi muscle.

† Also known as anterior lacrimal muscle (Gerlach, 1880).

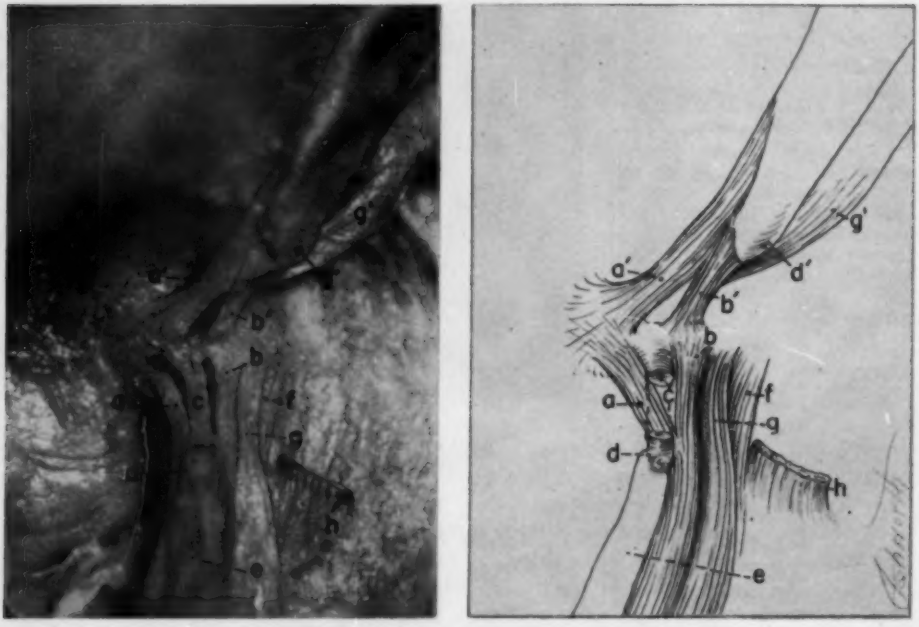

Fig. 3 (Jones). *Photograph of medial canthal dissection between upper and lower lids.* (a) Horner's muscles. (b) Superficial heads of pretarsal muscles. (c) Lower canaliculus (cut away in sketch). (d) Puncta. (e) Lower tarsus. (f) Lower orbital muscle. (g) Preseptal muscles. (h) Angular head of quadratus labii superioris muscle.

Horner's muscles have a common origin just posterior to the upper half of the posterior lacrimal crest. In addition to helping form the main body of the pretarsal muscle, each Horner's muscle is firmly attached by connective tissue to the canaliculus which accompanies it and gives off muscle fibers which insert into it and the medial end of the tarsus. Each Horner's muscle also gives off an isolated fasciculus, the pars marginalis of Riolan, which runs along the palpebral border of each lid.

The deep head of each preseptal muscle arises separately from the upper half of the lacrimal diaphragm, one above and one below the level of the internal common punctum. Each may be continuous with the origin of the superficial head. The superior may be so broad that some of its fibers arise from the lacrimal bone posterior to the posterior lacrimal crest.

The lateral palpebral raphe is the common insertion for all parts of the palpebral muscle.

The actions of the palpebral muscle divisions are:

1. All are tensor muscles, moving the nasal ends of each lid toward the nose.
2. All jointly retract the globe of the eye.
3. Each pretarsal muscle causes the upper and lower marginal tear strip to flow toward the lacus lacrimalis, squeezes the ampulla shut, and shortens the canaliculus.
4. The upper pretarsal and preseptal muscles are depressors of the upper lid.
5. The lower preseptal muscle is, to some extent, an elevator of the lower lid.
6. The deep heads of the preseptal muscles pull the lacrimal diaphragm laterally, creating a negative pressure in the tear sac.

The factors involved in moving the lacrimal fluid from its entrance in the upper

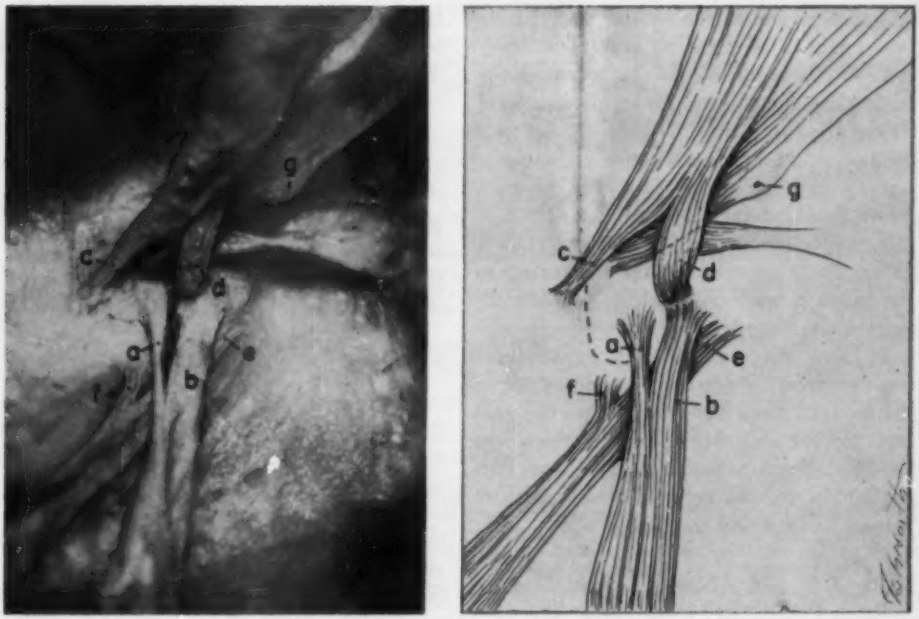

Fig. 4 (Jones). *Photograph of medial canthal dissection with pretarsal part of lower lid turned up.* (a) Deep head of preseptal muscle. (b) Superficial head of preseptal muscle. (c) Horner's muscle. (d) Superficial head of pretarsal muscle. (e and f) Superficial and deep origins of lower orbital fibers of orbicularis oculi muscle. (g) Lacrimal papilla and punctum of upper lid.

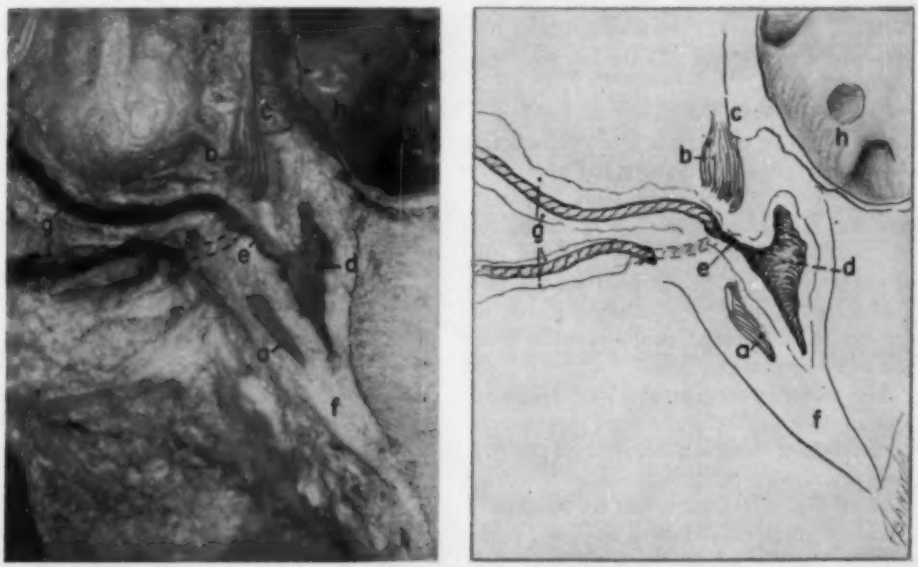

Fig. 5 (Jones). *Photograph of horizontal section through medial canthus.* (a) Deep head of upper preseptal muscle. (b) Horner's muscle. (c) Posterior lacrimal crest. (d) Lacrimal sac. (e) Sinus of Maier. (f) Anterior part of medial palpebral ligament. (g) Black thread in both canaliculi. (h) Anterior ethmoid cell.

conjunctival cul-de-sac to the floor of the nose might be summarized as follows:

1. *In the conjunctival sac.* Tear strips form along the palpebral margin of each lid. These are forced to flow medially not only by the medial movement of the lids but also because in blinking the lids close progressively from lateral to medial.

2. *In the canaliculus.* Capillary attraction, as well as compression and shortening of the ampulla and canaliculus, conducts the tears toward the tear sac.

3. *In the tear sac.* Alternate negative and positive pressure produced by movement of the lacrimal diaphragm, first draws the tears into the sac and then expresses them into the nose. Negative pressure in the nose during inhalation, snuffing, and gravity are also factors in emptying the sac.

Lacrimal pump

From the foregoing summary it can be seen that the movement of tears is most dependent on the structures which I have termed the "lacrimal pump." It consists of (1) the superficial and deep heads of the pretarsal muscles, (2) the deep heads of the preseptal muscles, and (3) the lacrimal diaphragm.

Instead of being confined to the lower lid, as I first reported, it is now evident that the "pump" also functions in the upper lid. I have three patients with only a patent superior canaliculus following operation on the tear sac. None of these patients has epiphora and each has a positive dye test (one drop of fluorescein solution placed in the eye should appear in the nose in from one to five minutes).

The anatomic concept of a lacrimal pump appears to settle the century-old controversy as to whether there is a negative or positive pressure created in the tear sac in blinking. It seems logical to assume that for maximum efficiency there should be a negative pressure in the sac at the same moment that the canaliculus is shortened and compressed. This is exactly what the lacrimal pump accomplishes. This is corroborated by clinical observation of mucus in fistulas and intranasal windows which recedes into the sac during the act of blinking.

Surgical procedures

In this paper no attempt will be made to discuss well-established surgical procedures. Rather, comment will be confined to (1) conjunctivodacryocystostomy, (2) conjunctivorhinostomy, and (3) surgical repair of injuries in the medial canthal region.

Conjunctivodacryocystostomy

Since beginning this study in 1952, I have done 10 such operations (table 1). In each eye operated on both canaliculi had been destroyed.

In the first two cases the conventional cutaneous approach to the sac was used. In the next seven the conjunctival approach, proposed in my preliminary report, was used. In Case 10 the cutaneous approach was used because the tissue had been badly distorted by a previous accident. The cutaneous approach has the advantage of easier exposure of the sac, less danger of perforating the sac in dissecting the fundus free, and less tendency for the ostium to migrate upward and away from the lacrimal lake postoperatively, as it did in Cases 6 and 7.

In general, it is best to handle the tear sac

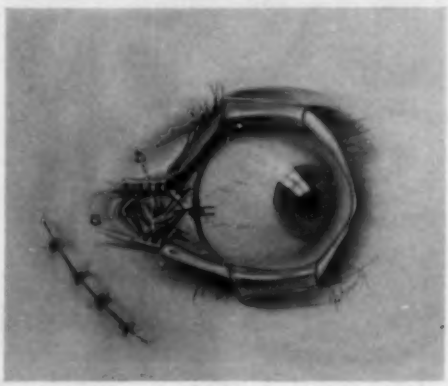

Fig. 6 (Jones). *Conjunctivodacryocystostomy.* (a) The medial half of the fundus of the tear sac. (b) Horner's muscle.

TABLE 1

SUMMARY OF CASES IN WHICH CONJUNCTIVODACRYOCYSTOSTOMIES WERE DONE

Case	Eye	Cause	Procedure	Post-operative Ostium	Dye Test	Result
1 (I.M.)	R	Idiopathic atrophy of canaliculi	Stallard transplant	Open	Neg.	Failure
2 (L.B.)	L	Same	Same	Open	Neg.	Failure
3 (I.M.)	L	Same	Transplant above Horner's muscle	Open	Pos.	Good
4 (L.B.)	L	Same	Same	Open	Pos.	Good
5 (L.W.)	L	X-ray treatment of adnexal cancer	Same	Open	Pos.	Good
6 (J.K.)	R	3rd degree burn (also x-ray treatment)	Same	Open	Weak Pos.	Poor
7 (J.K.)	L	Same	Same	Open	Pos.	Fair
8 (M.V.)	R	Intractable stricture	Same, 1st closed, 2nd mucosal graft	Open	Pos.	Good
9 (P.L.)	R	Trauma	Same, mucosal graft	Open	Pos.	Good
10 (T.M.)	R	Trauma	Same, mucosal graft	Open	Pos.	Good

in its periosteal envelope. Without the periosteum the tear sac mucosa is so friable that suturing is difficult. In operations requiring mobilization of the fundus of the sac it is best to separate the medial periosteal wall of the sac from the bone of the fossa and then to dissect carefully between the lateral periosteal wall (lacrimal diaphragm) and the deep muscle heads until the fundus is free. It is most important not to injure Horner's muscles.

The next step is to make a clean stab wound with a sharp pointed knife. The wound should be about 10 mm. long and extend from the conjunctival side between and parallel to the superficial and deep heads of the pretarsal muscles. The fundus of the sac is now split anteroposteriorly, pulled into the stab wound and sutured to its conjunctival margins with 5-0 mild chromic gut. The sac and ostium are packed with vaseline-lined umbilical gauze tape. This is removed on about the 10th postoperative day. If it is necessary to keep the ostium from narrowing after the packing has been removed, the patient can be taught to use the large end of a Ziegler double-ended punctum dilator for daily dilatation.

The first two operations were done by the Stallard[6] method. The apparent reason for their failure is that the stab wound in this procedure comes out inferior and lateral to the lower Horner's muscle and thus loses its all important pumping action. Because of preoperative trauma in Cases 8, 9, and 10, a piece of oral mucosa, about five by 10 mm. in size, was transplanted and sewed into the part of the wall of the new ostium where the epithelium was deficient.

Of the eight operations done by the new technique (Cases 3 to 10), clinical results were good in six; fair in one; poor in one.

CONJUNCTIVORHINOSTOMY

Four patients were subjected to conjunctivorhinostomy. One had had a previous dacryocystectomy, two had had dacryocystectomy following other operative efforts to establish drainage, and one had congenital absence of the entire lacrimal drainage apparatus.

Conjunctivorhinostomy can be done by

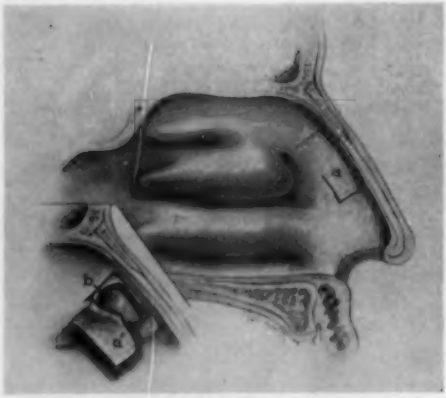

Fig. 7 (Jones). *Conjunctivorhinostomy.* (a) The nasal mucosal flap. Insert shows the flap (a) elevated and turned aside to show (b) the bony ostium made through the lacrimal fossa.

either the external or intranasal approach. Operations on the first two patients were done intranasally and on the last two externally. The nasal mucosal flap devised by Dr. Guy A. Boyden and myself[1] can be made by either approach. The intranasal procedure is the same as described in my preliminary report.[1] The external procedure is as follows:

The usual cutaneous incision is made and the periosteum, including the medial palpebral ligament, is elevated from the lacrimal fossa area. Care is taken not to go beyond the posterior lacrimal crest as Horner's muscles must not be disturbed. The bone of the entire floor of the fossa as well as the anterior lacrimal crest and lateral nasal wall are removed far enough to expose sufficient nasal mucosa for the formation of the flap. With a curved periosteal elevator the nasal mucosa is elevated at the margins of the bony window.

A stab wound is made through the conjunctiva following the course of the canaliculi as nearly as possible. If parts of the canaliculi are still present, they should be slit and the incision extended through them into the operative field. In this way the stab wound can be made about 10 mm. long and between the deep and superficial heads of the pretarsal muscles.

The nasal mucosa is incised in such a manner that the anterior superior corner of the flap will reach the posterior superior end of the stab wound without tension. It is sutured to the conjunctiva along the entire posterior side of the stab wound, using three sutures of 5-0 mild chromic gut. A tongue of nasal mucosa is then formed from the mucosa inferiorly, after which it is swung up and sutured to the conjunctiva on the anterior side of the stab wound. If there is not enough mucosa to make a complete tube, no concern need be felt as epithelium will form without difficulty postoperatively.

In closing the wound the medial palpebral

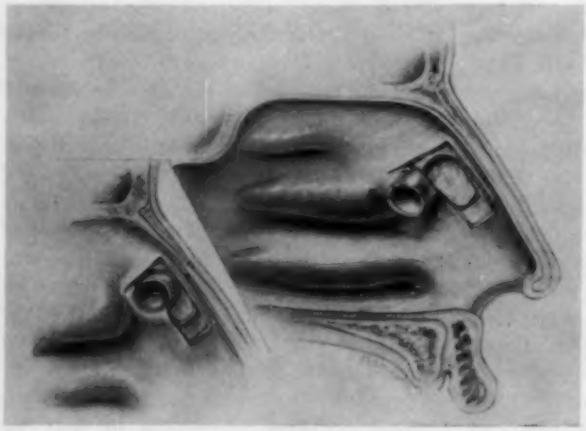

Fig. 8 (Jones). *Conjunctivorhinostomy.* The nasal mucosal flap (a) has been rolled back to form an epithelial-lined tube. Insert: The tube has been turned up and pushed through the bony ostium.

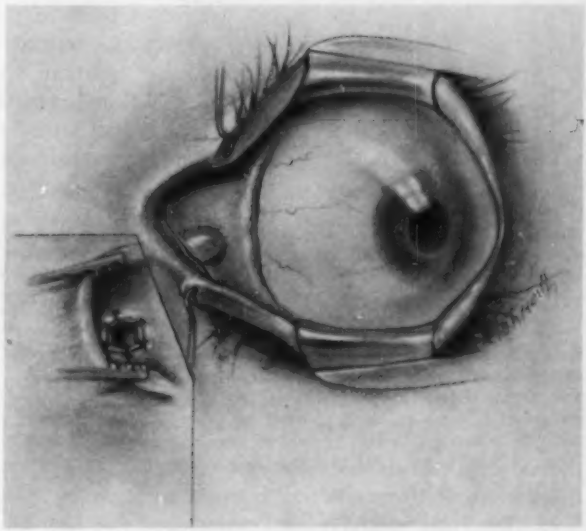

Fig. 9 (Jones). *Conjunctivorhinostomy.* The conjunctival incision extends from two mm. below and nasal to the punctum and extends backward, parallel to the upper border of Horner's muscle (lower leg). Insert: Nasal mucosal tube sutured to the conjunctiva.

ligament is sutured firmly to the deep fascia at the anterior margin of the incision. The new ostium is packed with umbilical gauze tape or a large piece of polyethylene tubing, three to four mm. in its outside diameter and about 18 mm. long. This should remain in place for about 10 days.

All four patients have patent ostia. In three epiphora has been relieved and each has a positive dye test. In the fourth, who had the congenital malformation, it is too recent to judge the result.

Surgical repair of injuries

Repair of lacerations of the medial canthal region presents a dual problem. It is necessary not only to strive for a cosmetic result but also to reunite the injured parts of the lacrimal apparatus. There is so much connective tissue in Horner's muscles that when indicated an attempt should be made to suture them to the periosteum in the region of the posterior lacrimal crest. Special care should also be taken to reunite the superficial heads of the palpebral muscle to the medial palpebral ligament.

The second problem is not only to find and suture the severed canaliculi together, but to keep the lumen patent. Various dyes, boiled milk, and other substances have been injected into one end of a duct to help identify the lacerated parts. It may be necessary to open the tear sac anteriorly and introduce a small hook to locate the nasal end of the torn canaliculus.

In the repair, a medium dermal (3-0) thread is passed through the entire injured duct and then through the sac and out through the anterior nares. The dermal is threaded through by means of a 23-gauge or 24-gauge hypodermic needle, about 32 mm. long with the cutting edge of its point ground off. After the needle is withdrawn, a small piece of 22-gauge polyethylene tubing is tied to the distal end of the thread and then pulled into the duct just far enough to maintain patency of the anastomosed part. After the tubing is in place, the canaliculus is repaired with 6-0 mild chromic gut on an atraumatic needle. The distal end of the tubing is taped to the skin and the nasal end of the thread is anchored to the cheek to hold the proximal end of the tubing in place.

As the palpebral muscle tends to pull the incision apart, a mattress stay suture should be used. A piece of 4-0 black silk, on a curved cutting needle, is introduced through

Fig. 10 (Jones). *Laceration of the lower lid* with a No.-22 gauge polyethylene tube in place. The external mattress suture is anchored in the skin and tarsus laterally and skin and deep fascia medially.

the skin and tarsus and back out through the skin about 10 mm. lateral to the laceration. The needle is then carried horizontally to the base of the nose, where it passes through skin and deep fascia and out through the skin again. The suture is then tied tight enough to immobilize the injured lid.

One of the main reasons for failure to get a patent duct postoperatively in injuries may be inadequate immobilization. The inflammation that invariably develops about tubing, wire, threads, and other material left in the canaliculi is caused chiefly by the constant to-and-fro friction on the epithelium when the duct in blinking rubs against the foreign body. To keep this movement of the lid at a minimum it is necessary to bandage *both* eyes for about six days. The tubing is left in the duct for six to 14 days.

Conclusions

It is apparent that not all of the anatomic parts of the lacrimal drainage system need be restored to cure epiphora. Not all of the parts of even the lacrimal pump seem to be indispensable. Relief of tearing may still be attempted as long as there is some degree of medial movement of at least one lid with a functioning Horner's muscle in it.

Summary

The medial palpebral ligament consists of an anterior part and a posterior part. The anterior part gives origin to all the superficial heads of the orbicularis oculi muscle. The posterior part gives rise to two previously undescribed muscles which are the deep heads of the preseptal muscles.

The lacrimal diaphragm consists of the periorbita covering the lacrimal fossa which is blended in its upper half with the posterior part of the medial palpebral ligament.

The lacrimal pump, which is present in each lid, consists of (1) the superficial and deep heads of the pretarsal muscle, (2) the deep head of the preseptal muscle, and (3) the lacrimal diaphragm.

Ten cases of conjunctivodacryocystostomy are reported. Results are encouraging. The procedure is simplified by the cutaneous approach to the sac.

Four cases of conjunctivorhinostomy are reported. A description is given of a technique for the formation of a nasal mucosal flap by an external approach.

Methods of adequate surgical care of medial canthal injuries are discussed. The importance of postoperative immobilization of the lids is stressed.

Medical Arts Building (5).

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DIFFUSE PERITONEAL MESOTHELIOMA*

WITH METASTASIS TO THE ORBITAL AREA AS A PRESENTING SYMPTOM

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Purpose

This case is unique since it is one in which a solitary metastasis to the left orbital area caused the first symptoms many months before the primary diffuse mesothelioma of the peritoneum was suspected. The presence of the metastasis resulted in the recording of symptoms and findings which, at the time, were not regarded as significant or were attributed to causes other than an abdominal tumor. X-ray and other studies were done during the relatively asymptomatic developmental period of the tumor's growth, with no definite findings. In retrospect the history shows that a diffuse peritoneal mesothelioma can be present for a long period without being found or even suspected and that definite symptoms and findings are late in their manifestation.

Case history

A 34-year-old white man of German-Jewish stock was first seen at Hines Hospital on September 1, 1952, complaining of protrusion and severe pain of the left eye. While in service in 1942, he developed a protrusion of the left eye after being struck in the eye by the buckle of a field pack. Since then he had had a shooting type of pain in the eye, varying from mild to severe in quality, accompanied with headaches and nausea. During the last month, a sudden dark discoloration of the left lower lid appeared.

Systemic examination disclosed hay-fever symptoms, loss of libido during the last two to three years, and neuralgic complaints of the left arm and leg. He had no gastro-intestinal symptoms other than recent constipation. Past history was noncontributory.

The patient was five feet, seven inches in height and weighed 169 pounds. Temperature was 98.6°F.; blood pressure 124/82 mm. Hg. General physical examination was nonrevealing except that the patient appeared in chronic distress, nervous, and preoccupied with himself. The left eye was proptosed five mm. beyond the right eye and the left lower lid was slightly ecchymotic. He also had pain on movement of the eyes in the cardinal fields of gaze but no muscle paralysis or paresis was noted.

Unaided acuity of the left eye was 20/30. Tonometry, ocular reflexes, visual fields, ophthalmoscopy, biomicroscopy, auscultation, and transillumination of the left eye were normal.

He exhibited hypertrophic tonsils, mild obesity, and moderate hirsutism but no associated thyroid, mammary, or testicular abnormality. Distribution of subcutaneous fat was normal and there was no increased sweating or dryness or pigmentation of skin. No intra-abdominal abnormality was noted. No objective neurologic findings were present. No endocrine dysfunction could be found. No clinical evidence of ear, nose, and throat pathology was noted. Admission urinalysis and serology were normal.

Red blood count 4,520,000; hemoglobin 14.5 gm.; white blood count 10,750 with a differential of 68 neutrophils, 29 lymphocytes, and three esosinophils. Basal metabolism rate was −14 percent. Bleeding and coagulation time were normal. Polyagglutination tests were negative. X-ray examination of the skull, optic foramina, chest, and left cerebral angiogram disclosed no abnormality.

On October 26, 1952, there was neurosurgical exploration for a retrobulbar tumor by way of a left transfrontal osteoplastic craniotomy. The bony orbital roof was very thin posteriorly and, after being opened, the periorbital fat bulged under considerable pressure; however, no tumor was found. Postoperatively the patient had a transient aphasia and was discharged with residual right-sided hemiparesis on December 15, 1952.

He returned to the hospital on May 8, 1953, because of recurrence of his original symptoms along with low back pain and a burning sensation in the epigastrium. Blood pressure was 120/80 mm. Hg; pulse 82, temperature 98. Naked acuity of the left eye was 20/50—2, with the left eye now proptosed eight mm. There was exposure keratopathy of the inferior third of the left cornea. The left eye showed a limitation of action in the fields of the left medial rectus and left inferior oblique with subjective pain in all fields of gaze.

Except for equivocal ophthalmoscopic suggestion of venous distention no other objective ocular findings were noted.

Abdominal examination at this time showed it to be flat, not rigid, nontender, and with no masses palpated. Axillary and epitrochlear nodes were palpated without other significant adenopathy.

Urinalysis, serology, and hemograms were normal. Blood cholesterol, repeated basal metabolism rate studies, and a radioactive iodine study showed the patient to be euthyroid. Emperic therapeutic trial with thyroid effected no change in his proptosis.

* From the Departments of Ophthamology and Pathology, Veterans Administration Hospital.

Neurologic examination disclosed minimal right hemiparesis with the impression that the patient was potentially capable of doing more than he would admit. Psychiatric consultation revealed a severe chronic anxiety state and recommended that no surgery be contemplated until further psychiatric evaluation could be performed.

On July 11, 1953, a vague, smooth, anterior ridge of a domelike mass was palpated inside of the left orbital rim from the 3- to 5:30-o'clock position but this was not substantiated by other observers. The patient refused to permit biopsy. Dental evaluation was noncontributory.

X-ray studies of the orbits on May 12th and 19th and July 10th gave no evidence of abnormality in the optic foramina or orbits. Gastrointestinal series on June 8th suggested old duodenal ulcer without demonstrable crater formation. Chest X-ray studies of July 15th showed right hilar prominence with suggestion of a mass but subsequent Bucky-Grid films did not substantiate this.

Skull X-ray films on the same date showed only cranioplasty of the left side without change from previous films. Ear, nose, and throat examination with transillumination of the antra failed to demonstrate the presence of a space-occupying mass involving the floor of the orbit.

A faint one-plus reaction was obtained with first strength PPD; no eosinophilia was present. Biopsy of an axillary node showed chronic lymphadenitis. An electroencephalogram taken on July 20th showed no slow focus. After discontinuing all medication, an electroencephalogram was repeated on July 27th and interpreted as abnormal with many positive spike discharges appearing in the left and right hemispheres, these discharges being on a thalamic basis. No visual field abnormalities were obtained on examination on July 23rd. Because the patient rebuffed any suggestions of further surgery he was discharged on July 29th.

The patient was readmitted to the hospital on May 1, 1954, because of more severe and steady ocular pain over the preceding five days, with nausea and vomiting.

Eye examination showed the acuity of the right eye to be 20/30, correctible to 20/20—1; left eye, 20/100, correctible to 20/40—1. External examination of the left eye (fig. 1) showed that the lids were distended and purplish in hue, and the left eye 11 mm. in advance of the right eye.

A definite mass was now palpated inside the rim of the inferior temporal aspect of the orbit. The cornea showed a nebulous, nonstaining, superficial haze in its lower half, with a widened palpebral fissure (fig. 2). The left pupil was slightly larger than the right and reacted less briskly to the light reflex.

Ocular tensions were normal. The extraocular muscles of the left eye demonstrated a marked limitation of motion in all fields of gaze. Ophthalmoscopy of the left eye revealed only perimacular edema.

Hemograms and urinalysis were not remarkable. No changes were noted in the orbit or sinuses from previous X-ray studies. Upper gastro-intestinal examinations suggested characteristic gastric prolapse into the base of the duodenal bulb, causing a defect there; the four-hour film showed no gastric retention. Chest X-ray films were normal.

On May 14th, the patient was taken to surgery where Krönlein decompression of the left orbit was performed and a well-encapsulated chocolate cyst, approximately three cm. in size and extending into the apex of the orbit, was removed from the inferior temporal aspect of the orbit. This was diagnosed as old hemorrhage after microsection.

The postoperative course was uneventful, with the gradual subsiding of the proptosis and lid edema, and the patient was sent on leave of absence to convalesce at home. He returned prematurely in one week complaining of severe generalized abdominal and head pain.

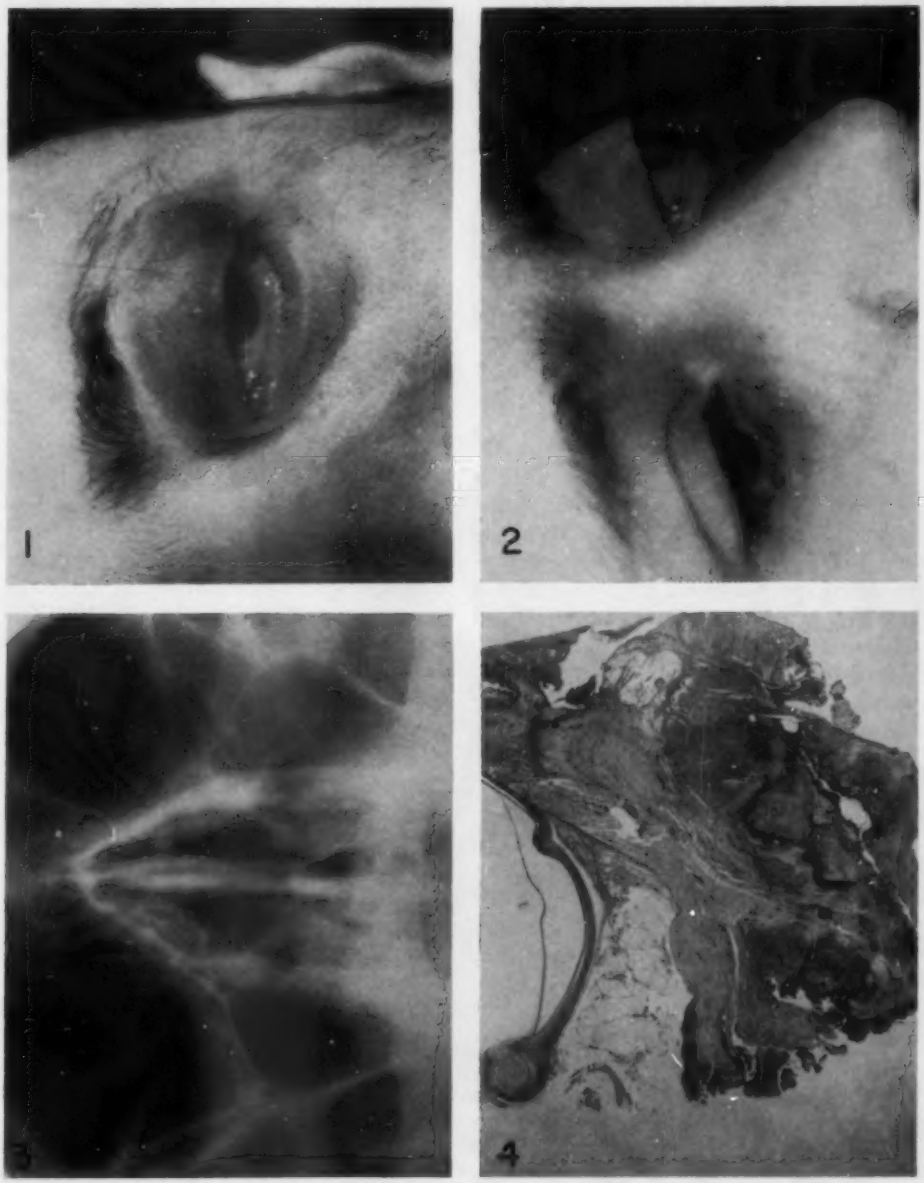
The protosis subsequently increased, with marked chemosis of the bulbar conjunctiva, and a complete ophthalmoplegia developed, with loss of light perception and anesthesia of the ophthalmic and maxillary branches of the fifth nerve. A canthotomy was performed to no avail.

Although body section radiographs of the orbit taken on May 10th showed no change from previous films, and conventional skull and Bowen-Hertz films taken on July 8th disclosed no pathologic condition, repeat films of the paranasal sinuses on July 14th showed an osteolytic area in the roof of the left orbit, not previously present, a polypoid mass in the left antrum, nonvisualization of the sphenoids, and changes suggesting left malar bone pathology (fig. 3).

Ear, nose, and throat examination at this time disclosed some clinical blockage of the nose in the left side but with no evidence of any undue pathologic process; however, there was a marked filling of the left gingivolabial groove and undue prominence and induration of the left malar and maxillary regions.

On July 23, 1954, under general anesthesia a Mori-Ferguson approach to the left antrum was made and there was seen a fleshy, friable, pale-pink tumor mass extending into the left maxillary antrum from the infralateral aspect of the left orbit. Frozen section suggested neurogenic sarcoma and therefore surgery was carried forward with exenteration of the left orbit (fig. 4). Dissection of the left malar bone and inferior orbital plate showed considerably more tumor tissue in the medial aspect of the retro-orbital space. A defect was seen in the bony ethmoid plate and another palpated in the superior medial aspect of the orbit in the direction of the anterior cranial fossa. The case was considered inoperable.

The permanent sections were interpreted as reticulum-cell sarcoma, with reservations. The skin incision healed by primary intention; deep roentgen therapy was given to the left orbital area and completed by September 1, 1954. During the last week in August, the patient began to complain of dyspepsia and abdominal distention. At first, it was felt that these were effects of irradiation; however,



Figs. 1-4 (Penn and Godwin). (1) The lids are distended and purplish in hue; only anterior displacement of the globe is present. (2) Oblique view on May 5, 1954, showing widened left palpebral fissure and proptosis. (3) X-ray view of paranasal sinuses on July 14, 1954, showing polypoid masses in the upper and lower portions of the left antrum. The left antrum is almost entirely opaque. (4) Section through the orbital contents shows the optic nerve entering the globe below and the conjunctival sac above. A large tumor mass lies medially at the right in the soft tissues about the eyeball.

these symptoms persisted. Liver, kidney, and spleen were not palpable and, although clinically he had no evidence of obstruction, considerable tympany was elicited over his stomach and large bowel. Both upright and abdominal flat plate X-ray studies at this time demonstrated no definite abnormality but, within a week, it became apparent that he was developing ascites.

After paracentesis the liver was believed to be six to seven finger breadths down and was tender and nodular; there were multiple hard tender masses studding the entire abdominal cavity which gave the impression of generalized abdominal metastases. Abdominal paracentesis yielded blood and tumor cells on Papanicolaou stain.

The patient was from that time treated symptomatically with blood transfusions and frequent abdominal paracenteses (on one occasion 9,000 cc. was recovered) and large doses of analgesics. He soon became emaciated and somnolent and died November 29, 1954, several hours after a convulsive episode.

Pathology report

At autopsy there was 4,000 cc. of bloody ascitic fluid. The peritoneum was covered by nodular gray-white tumor masses. The omentum and transverse colon area showed the largest tumor masses measuring up to 14 cm.; despite the size of the tumor masses no necrosis was present. The bowel and stomach showed no involvement of the mucosal surface. The bowel, as well as the large vessels and bile ducts, showed compression by tumor but no obstruction was evident. The diaphram was covered by tumor on the inferior surface but there was no penetration to the superior surface by the tumor as frequently occurs. The hilus and surface of the liver were heavily involved but no tumor was found isolated deep in the liver parenchyma. The tumor covered the spleen and pancreas but did not involve their parenchyma. The remainder of the abdominal organs showed no involvement by tumor. The retroperitoneal area showed no involvement after the abdominal contents had been removed.

The lungs were free of tumor on gross examination. The right lung weighed 230 gm.; the left 210 gm. No tumor was found in the mediastinum or in any part of the thoracic cage. The heart was small and showed no special pathologic process. The brain weighed 1,300 gm. and no special lesions were found.

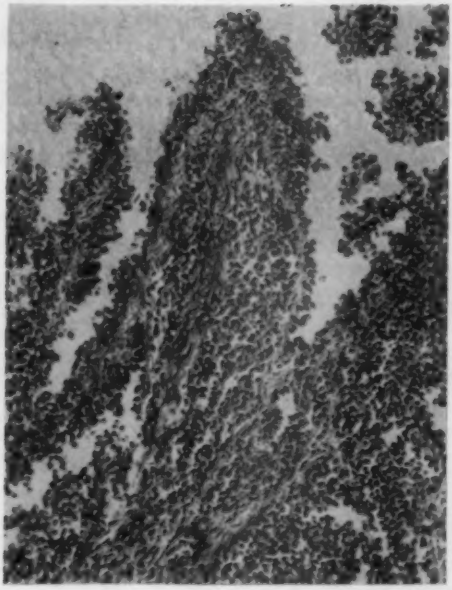
Microscopic examination showed the tumor to be confined to surfaces except in the omentum where penetration into the fat and connective tissue had occurred. The tumor had also grown out along the path of the paracentesis to a position in the skin similar to a case reported by Rose, et al.[7]

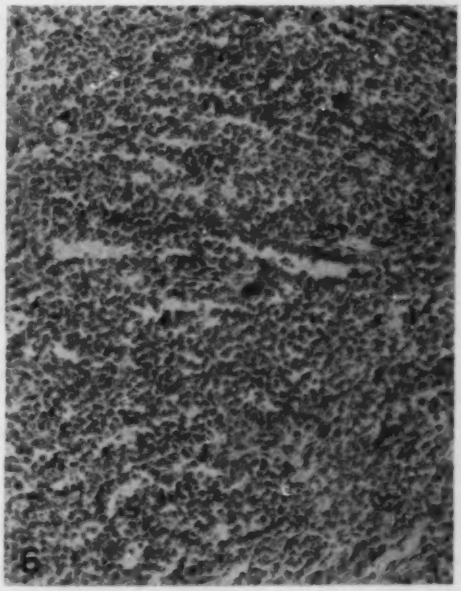
The tumor in typical areas was composed of complex branching papillary formations covered by irregularly heaped-up layers of epithelial cells (fig. 5). The epithelial cells were large with large vesicular nuclei with prominent nucleoli and a well-defined nuclear membrane. Often the nuclear wall was folded or crinkled in a distinctive manner. The cell wall was often well defined. The cytoplasm was slightly granular and eosinophilic.

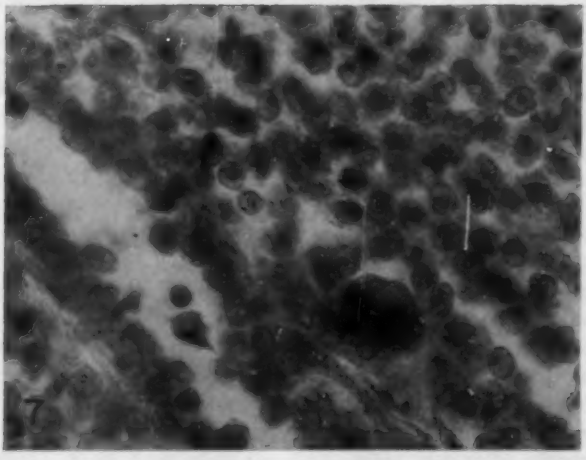
The epithelial cells rested on a connective tissue stroma which varied in abundance from place to place. The cells of the surface epithelium in some places were being transformed into stromal cells and showed intimate relation to connective tissue fibers. The stromal nuclei in some regions showed evidences of malignancy such as enlargement, irregularity, and hyperchromatism. Mitosis in both the stroma and epithelium were fairly abundant.

The autopsy findings did not confirm the previous diagnosis of reticulum-cell sarcoma involving the retrobulbar space, antrum, ethmoid area, and zygoma so a re-evaluation of the sections from these areas was necessary. Re-examination showed obscure papillary formations (fig. 6) with a minimal amount of stroma.

There were slitlike spaces with epithelial cells covering the surface (fig. 7). The nuclei showed a prominent nucleolus with well defined, folded, indented, crinkled nuclear membranes as previously described for the peritoneal tumor mass. Figure 7 also shows a large multinucleated tumor giant cell which has been described in other cases of mesothelioma.[3] Comparison of the histology of







Figs. 5-7 (Penn and Godwin). (5) This view shows papillary formations covered by loosely adherent layers of epithelial cells. Cells of the stroma are elongated spindle type. (6) This view is an area from Figure 4, showing obscure papillary formations with minimal stromal component and slitlike spaces lined by epithelial cells. (7) This view is an area of Figure 6, showing epithelial cells lining small slits. The nuclei have a well-defined, indented, crinkled membrane and prominent nucleolus. A multinucleated tumor giant cell is shown. Surface and epithelial cells show the same characteristics.

the tumor of the orbital area with that involving the peritoneum leaves no doubt that they are the same tumor.

Discussion

The autopsy findings in our opinion leave no doubt that this is a case of diffuse peritoneal mesothelioma with metastasis to the left orbital area. This case appears to be unique in that the metastasis produced the first symptoms. It also was the only metastasis ever found. Mesotheliomas are often regarded as slow to metastasize[1] and yet there are reports describing such cases. The route of the metastases is intriguing, since no tumor was found in the lungs. This fact need cause no concern, however, since similar findings in various tumor cases are not unusual.

The diffuse mesothelioma according to Stout[9] spreads along the surface and almost never metastasizes to distant sites. There are reports, however, of distant metastases[2-6,10] which appear to be blood borne. There can be no doubt that blood-borne metastases are quite rare especially when the extent of the tumor is considered. The case reported here is especially unique since the solitary retrobulbar metastasis not only caused the first symptoms in a critical area but the primary tumor caused no symptoms and its presence was not suspected. It is impossible to state how long a peritoneal mesothelioma may be present before symptoms occur but we feel that it may be many months and even years. Although tumor was not proven to be present in the orbit until almost 22 months after admission we were confident it was there, as well as on the peritoneum. Since the patient lived 27 months after admission, we feel that he had the primary tumor during this period and probably much longer. Ascites did not develop until three months before he died. This shows that ascites, although a constant finding in mesothelioma of the peritoneum, is probably a late manifestation.

The patient complained of recent constipation on admission. It is noteworthy that low back pain and burning in the epigastrium was recorded eight months after admission. Nausea and vomiting at 19 months was believed at the time to have resulted from eye pain. It was not until 23 months after admission that dyspepsia and distention soon followed by ascites led to a paracentesis with a diagnosis of malignant tumor, type undetermined.

Saphir[8] has emphasized the difficulties of diagnosis from smears and sections of concentrated sediment from pleural and peritoneal fluids. It is evident that the presence of critical eye symptoms resulted in the recording of abdominal symptoms which otherwise would never have been noticed and certainly not remembered by the patient.

X-ray studies of the gastro-intestinal tract as late as three months before death were not revealing.

This case shows that symptoms and findings, as well as X-ray studies, may be of little value even though an extensive mesothelioma is present.

The cytologic study of ascitic fluid resulted in a definite diagnosis of malignant tumor in the abdomen but only the autopsy and subsequent review of the previous surgical specimens established the diagnosis of diffuse mesothelioma with a solitary metastasis.

Conclusion

A case of diffuse papillary mesothelioma of the peritoneum is presented. There was one metastasis to the left orbital area, resulting in severe ocular symptoms and eventually requiring exenteration before the primary lesion was suspected.

The presence of the orbital metastasis resulted in the recording of early abdominal symptoms and findings and in X-ray studies of the gastro-intestinal tract which otherwise would probably have never been made. This supports the view that abdominal symptoms and findings are probably a late manifestation of diffuse peritoneal mesotheliomas.

Veterans Administration Hospital.

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ANGIOID STREAKS OF THE FUNDUS*

In association with posthemorrhagic amaurosis

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Angioid streaks are seen relatively rarely, with only over 200 cases reported in the literature.[1] Their basic histopathology seems to be generally accepted as representing ruptures and breaks in the lamina vitrea, although the pathogenesis of these ruptures is not well understood.[2] Their association with Paget's disease and pseudoxanthoma elasticum (Grönblad-Strandberg syndrome), together with subsequent degenerative and hemorrhagic disease in the macular area, has indicated that angioid streaks may be an ocular manifestation of a generalized elastic tissue disturbance. It has been suggested that elastic tissue disease in the walls of the blood vessels may account for the tendency to hemorrhage in the eye and elsewhere in the body.[3,4] This hemorrhagic tendency, especially in the macular area, accounts for the poor visual prognosis in these patients.

McWilliam,[5] in classifying angioid streaks, distinguishes those associated with generalized elastic tissue disease from secondary angioid streaks which he feels are not related to elastic tissue disease but are due to the accumulation of pigment in local lesions. However, pathologic study of enucleated eyes correlate the ophthalmoscopic findings of angioid streaks with dehiscences of Bruch's membrane.[2,3,6]

In looking through the literature, I have found no direct reference to generalized hemorrhagic disease preceding the development of angioid streaks. The purpose of this paper is to report a patient with classical angioid streaks whose hemorrhagic phenomena were directly attributable to a well-known generalized disease which has no known relationship to elastic tissue pathologic alterations and in which the hemorrhages apparently preceded the development of ocular disturbances—namely, angioid streaks and optic atrophy.

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* From the Montefiore Hospital. Harvey E. Thorpe, M.D., Chief of Ophthalmology Service. This paper was presented before The Pittsburgh Ophthalmological Society, May, 1956.

Report of case

A 29-year-old white woman presented herself to the emergency room on September 29, 1955, complaining of severe right frontal headache and right periorbital pain associated with chills and fever. A diagnosis of acute frontal sinusitis was established and the patient responded well to treatment.

In the course of initial examination a visual deficiency was detected, and the patient was seen in the ophthalmology department that day.

The patient's pertinent history, as determined by interview and checking the charts of previous hospitalizations elsewhere, revealed that the patient had been hospitalized on February 4, 1945, as a result of a shock syndrome due to a marked secondary anemia following six days of severe gastrointestinal bleeding. She was treated with plasma, blood transfusions, Coramine, hematinics, and sulfadiazine.

Nine days after onset of bleeding, marked blurring of vision in each eye was noted. On February 22, 1945, an ophthalmologist noted retinal hemorrhages around the margin of each disc associated with bilateral fundus pallor, pigmentary macular changes, and marked granularity of the retinas, and felt that these changes were secondary to the marked anemia present.

Vision in the right eye began to improve on February 28, 1945, but vision in the left eye did not improve. By March 9, 1945, her general condition had stabilized and she was discharged from the hospital.

In October, 1945, she was admitted to another hospital in an almost exsanguinated state as a result of further gastrointestinal bleeding. A diagnosis of idiopathic thrombocytopenic purpura was established, and a splenectomy was performed with a dramatic response in patient's platelet count and a permanent subsidence of the bleeding episodes.

On December 23, 1945, ophthalmologic examination revealed the visual acuity to be: O.D., hand movements; O.S., 6/60, with bilateral pale discs and severe generalized reticular degeneration in each eye. The ophthalmologist's impression at that time was optic atrophy secondary to blood loss. Since this hospitalization there has been no known pathologic bleeding or any change in visual status apparent to the patient.

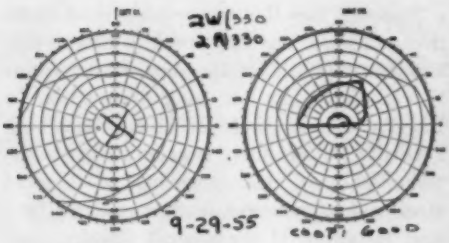
Ophthalmic examination on September 29, 1955, revealed the visual acuity to be: O.D., 20/30+3 correctible with a +0.5D. sph. to 20/20; O.S., light projection temporally, not corrected with a cycloplegic refraction of +0.5D. sph. $\bigcirc$ +0.25D. cyl. ax. 85°.

Both pupils were round and equal. The right pupil reacted well to light and accommodation, but it reacted sluggishly consensually only when a bright light was directed by the slitlamp from the temporal area of the left eye. The left pupil reacted sluggishly only when a bright slitlight was directed from its temporal side, but it reacted briskly consensually.

A 25-degree left exotropia was present for near and distance in all directions of gaze. Intraocular pressure was 17 mm. Hg in each eye (Schiøtz, 5.5 gm.). The lids, conjunctiva, cornea, iris, and anterior chamber revealed no pathologic condition and the lens and vitreous were also normal to biomicroscopic examination. Gonioscopy revealed a normal open angle in each eye.

Field study of the right eye revealed the entire inferior field to be absent with a marked constriction of the nasal and temporal superior quadrants to two-mm. white and two-mm. red objects at 330 mm. This was also demonstrated on the tangent screen. The left eye revealed no field at all for an 18-mm. white object at 330 mm. or one meter (fig. 1).

Fundus study (figs. 2 and 3) revealed the left optic nerve to be white, with a sharply demarcated margin and absence of the normal capillarity of the disc. The right optic nerve was also pale but the whiteness was



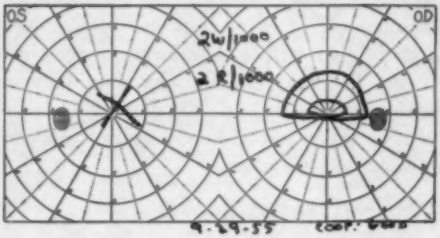


Fig. 1 (Yatzkan). Peripheral and central fields.

more marked in the superior portion of the disc. The right disc also demonstrated a sharply demarcated edge and a marked diminution of the normal capillarity.

Increased pigmentation was noted in the macular regions of both eyes. The inferior temporal quadrants of each fundus showed marked mottling by dustlike brownish stippled areas interspersed with numerous small white areas. The retinal veins were of normal

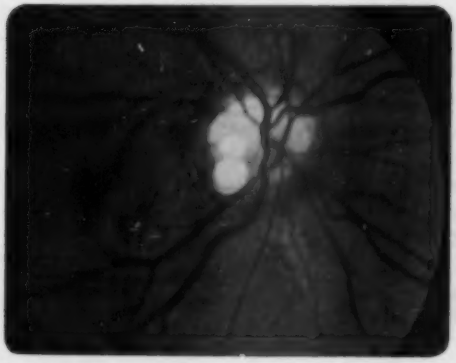


Fig. 2 (Yatzkan). Fundus photograph of central area, O.D.

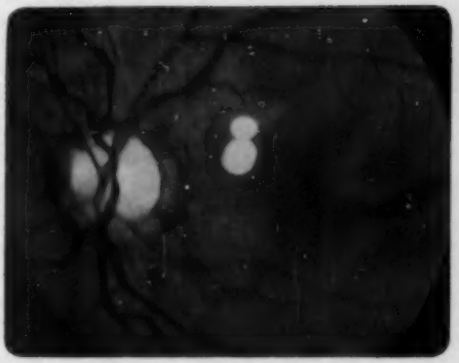


Fig. 3 (Yatzkan). Fundus photograph of central area, O.S.

caliber. Some of the retinal arterioles were constricted. Others were normal. There was no increased tortuosity. No hemorrhages, exudates, or elevations were noted.

In each fundus, angioid streaks of reddish brown color forming a complete ring around the nervehead were noted, with emanations extending radially from the central ring toward the equator. The central rings were partially enmeshed in a grayish white area. The streaks were irregular and ragged and some were partially surrounded by a grayish white border. With the Hruby lens, these streaks were noted to lie between the choroidal and retinal vessels.

Laboratory study revealed no hematologic deficit. Serology was negative, as was urine study. X-ray films revealed no evidence of Paget's disease and general physical examination was negative except for the manifestations of sinusitis. No evidence of pseudoxanthoma elasticum was found.

Comment

In this case, the hemorrhages and optic atrophy appear to be directly related to idiopathic thrombocytopenic purpura and it does not seem necessary to indite generalized elastic tissue disease as causing the ocular changes.

Interestingly, in Duke-Elder's *Textbook*

of Ophthalmology[7] attention is drawn to the associated optic atrophy, pigmentary disturbances, and angioid streaks in a fundus drawing used to demonstrate ischemia of the retina after exsanguination following hematemesis. This drawing is quite similar to the fundus photographs of this case (figs. 2 and 3). This tends to infer that the occurrence of angioid streaks in association with exsanguination might be more than coincidental. It is possible that the marked acute anemia with resultant shock to the blood supply of the optic nerve may also have interfered with the nutrition of the elastic fibers of the lamina vitrea, resulting in defects manifested as angioid streaks. It is suggested that in the present case report, the angioid streaks might not be due to generalized elastic tissue disease but rather to local elastic tissue disease secondary to hemorrhage. This is contrary to the concept that elastic tissue disease, manifesting itself as angioid streaks, results in hemorrhage.

It is felt that this relationship is of more than academic interest, for it is conceivable that the prognosis for future visual deterioration is dependent on the pathogenesis. In Paget's disease and Grönblad-Strandberg syndrome, where there is generalized elastic-tissue disease, the presence of angioid streaks almost insures further macular damage. However, if the angioid streaks are a result of previous hemorrhagic episodes which are now controlled, the prognosis for maintenance of vision improves considerably and further visual deterioration need not occur. This may explain why some patients with angioid streaks do not develop impaired central vision, while others go on to severe macular degeneration.

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Acknowledgment is made to Dr. Harvey E. Thorpe, Chief of the Department of Ophthalmology, Montefiore Hospital, who furnished the fundus photographs.

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OPHTHALMIC MINIATURE

Mr. E. Treacher Collins spoke of a covey of pheasants at a shoot which refused to rise for the guns, and it was found that they could not see. One was sent to him for examination and he found it had a vascular cornea there was typical interstitial keratitis and a large cellular exudation with a marked development of vessels in the substance of the cornea.

Archives of Ophthalmology, **54**:507, 1925

CLINICAL PATHOLOGIC CONFERENCE*

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CLINICAL HISTORY FOR CASE 1†

Present illness. A 32-year-old white veteran of World War II was critically ill, confused, and could not give a reliable history when admitted to the hospital March 24, 1953. He had been unable to work for several weeks but had been confined to bed for only 10 days. Although he had not vomited, he had noticed blood in his mouth. No rectal bleeding had been observed. The patient complained of abdominal pain but was unable to localize it. He admitted to use of alcohol but did not indicate how much nor for how long.

Past history. The patient had been a laborer before World War II and a sawmiller since the war. He served in Germany during 1944-45. He had not had any significant childhood illnesses and was in good health during his military service. He had been admitted to the same hospital September 20, 1952, because of painful swelling of the right eye of three days' duration. He had thought that he had a speck in his eye and had rubbed it a good deal with the result that it became painful and swollen, and when he was admitted he was unable to use it. The bulbar conjunctiva and cornea of the right eye were so edematous that the widely dilated pupil was barely visible. The pupil did not react to light. The fundus could not be visualized. The right iris appeared dark brown while the left was light blue. The left eye was entirely normal. Physical examination was negative, but it was noted that the patient's breath was alcoholic. Laboratory studies, including X-ray films of orbit, paranasal sinuses, and chest were not significant.

The patient was treated with penicillin and cortisone (drops and injections) for eight days, but with little improvement. Blood appeared in the anterior chamber and synechias developed. Consultation as to the advisability of enucleation was obtained on October 13, 1952. The consultant said the patient could go home if warned of signs of sympathetic ophthalmia or abscess. He was dismissed the following day and given aureomycin and atropine for local application. He was instructed to return in five days, but his next and final admission was not until March 3, 1953.

Family history. The only pertinent fact was that his mother died with jaundice.

Physical examination. The patient appeared fairly well developed, but poorly nourished and critically ill. He was confused, lethargic, and moderately jaundiced. A few petechias were noted over the left shoulder and the skin was yellow. No spider angiomas were found. The scleras were yellow. There was extensive scarring of the right cornea and the pupil could not be visualized. The right lid drooped. The left eye was normal. There appeared to be bleeding from the gums, all of the oral tissues being covered by blood. The teeth were in poor condition. Thorax, heart, and lungs were not remarkable. The abdomen was tense with dilated superficial venules over the upper half. The firm liver edge extended to the right iliac crest. Another mass (spleen or liver?) extended from the left upper quadrant to the

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† AFIP Accession No. 612166.

umbilicus. A fluid wave could not be demonstrated. There was 2-plus pitting pretibial edema. Neurologic examination was negative.

Laboratory data. WBC 15,800; 24,100, and 18,900, with normal differential counts; RBC 2.8, 2.18, and 3.6 million, with 9.5, 8.5, and 11.0 gm. hemoglobin. Urinalysis revealed specific gravity of 1.012, a trace of albumin, and a positive reaction for bile. Total protein was 4.9 gm. percent with A/G of 1/1. Icteric indices were 112 and 138. Serum bilirubin was 24 mg. percent, creatinine 2.2 mg. percent, glucose 95 mg. percent, CO_2 50 vol. percent, sodium 133 and potassium 4.7 milliequivalents, chlorides 511 mg. percent. An X-ray film of the chest revealed an unusually high diaphragm, but was otherwise negative.

Hospital course. The patient was afebrile on admission, but during most of the next four days his temperature varied from 100 to 102.6°F. The evening of the day he was admitted the patient vomited considerable blood. He was treated with intravenous glucose, vitamins, and blood transfusions, but died on the fourth day after admission.

Differential diagnosis—Case 1

Dr. Adler

After reviewing the history of this very interesting case I am convinced that the reporter was not under oath. He undoubtedly told the truth and nothing but the truth, and therefore did not subject himself to perjury, but I think we had better not press him too hard as to whether he told the whole truth. Let us examine with a critical eye some of the statements he made which are quite evidently stressed in order to serve as distractors, or what we might call red herrings, so that the poor unsuspecting discusser will be led astray.

Five months previous to the patient's final admission he was admitted with a swollen right eye of three days' duration. The eye was painful and swollen, and he thought he had a foreign body in it. We are told that the bulbar conjunctiva and the cornea of this eye were edematous, and that the pupil was widely dilated and did not react to light. The fundus could not be visualized but we are not told why. Finally blood appeared in the anterior chamber, and synechias developed, following which, mirabile dictu, a consultation was requested as to whether enucleation should be performed. If I were a good hound dog I would certainly want to do a lot of sniffing in that wood pile before I decided to go on in after a rabbit. With only that much information why would any self-respecting ophthalmologist request a consultation as to whether an enucleation should be performed? Obviously the ophthalmologist in the hospital knew much more about this case than the ophthalmologist in this report.

Following that, a most amazing statement appears. "The consultant believed the patient could go home if warned of signs of sympathetic ophthalmia or abscess." That certainly suggests that the eye had suffered a perforation. The patient did go home, with instructions to return in five days, and showed up five months later.

Finally, one more delicate insinuation appears in the statement that, "the right iris appeared dark brown, while the left was light blue." For the first second after reading this statement the thought flashes through one's mind of a Fuchs' type of heterochromia, in which, of course, it is the eye with the light iris which suffers the inflammatory attacks. Here, the situation is reversed, and this possibly gives a real clue to our trouble.

On the second admission, the right cornea showed extensive scarring, and the pupil again could not be visualized. There was a right ptosis, and that is all the information we have of the eye at that time. We are, therefore, left with the unhappy conclusion that this man had a perforation which was missed at his first examination, but which was finally suspected after eight days of treatment with penicillin and cortisone. The only alternative is to suspect the reporter of

ulterior motives and assume that these are all red herrings.

Now, how about the general examination—jaundice, enlarged liver, two statements about alcohol, in a 32-year-old white veteran with a history of blood in his mouth. This would certainly suggest a Laennec's cirrhosis, which is common in men aged 45 to 65 years, and associated with alcoholism. In a series of patients quoted by Cecil, epistaxis occurred in 40 of 124, and hematemesis in 34 of 124. These patients usually are rather acutely ill; the majority show spider angiomas over the upper portion of the body or neck, which he did not, but the liver is usually small and there is no splenomegaly or other masses in the abdomen. These patients usually have a macrocytic type of anemia. No mention is made in this case of a bromsulfalein test or cephalin flocculation and thymol turbidity tests.

The main argument against Laennec's cirrhosis is that I cannot fit the eye into this picture. How about the mother's dying with jaundice?

Hanot's cirrhosis frequently affects females. The liver is large and there is a splenomegaly which would fit into this picture, but generally the patients are not acutely ill and have no fever. This is a rare disease, however, and again I cannot fit the eye into the picture.

Leukemia might be considered, but this would have to be an aleukemic leukemia. Porphyria was suggested by one of my resident staff, Dr. Williams, because of the mother's dying of jaundice. There is, however, no other evidence to suggest this. This man had a mass in his abdomen with a palpable liver. Is this an obstructive jaundice on the basis of neoplasm? The bleeding from the gums could follow the marked anemia and jaundice with low vitamin K.

Obviously the eye must tie into this picture somewhere. This forces us to drop the thought of a perforating injury and to assume that this man had a malignant melanoma originating in his eye, which was not recognized at his first admission. After five months this spread to his liver, and from this he died.

This fits in well with the fact that the iris of the right eye appeared dark brown, while the left was light blue, since it has been shown that malignant melanomas are more frequent in eyes with iris freckles. My guess would be, therefore, that this man had a malignant melanoma which was not recognized, and which at the time of his first admission had probably caused a secondary glaucoma, which again was not recognized, but which resulted in edema of his lids and conjunctiva and a dilated pupil. Only about 50 percent of intraocular tumors cause glaucoma. Hyphema developed and this probably led to blood staining of the cornea, which prevented any subsequent view of the interior of the eye.

I will admit that this diagnosis leaves the consultant who warned about signs of sympathetic ophthalmia or abscess pretty far out in left field. However, when Dr. Zimmerman tells us what this patient actually had, I may find myself being traded to one of the minor leagues!

Pathology and discussion—Case 1

Dr. Zimmerman

Dr. Adler has obviously had much experience with pathologists and their methods for doctoring the record in order to spice up the discussion! I must say, however, that in the present case it was not necessary to do this. After consulting the original hospital records, it was evident that the attending ophthalmologists were as confused as the protocol suggests. The only pertinent additions I can make to the record you have been given are the final clinical diagnoses:

1. Laennec's cirrhosis of the liver with superimposed acute hepatitis and liver failure;

2. Blindness, right eye, residual of old injury.

Before telling you about the results of autopsy, I would like to elaborate on the bait

which Dr. Adler nibbled so cautiously—the heterochromia iridis. Whenever a patient with ophthalmologic complaints is observed to have heterochromia, two questions should be asked:

1. Was the heterochromia present long before the present illness or did it develop only in association with the ocular disease?

2. Is the diseased eye the light one or the dark one?

Heterochromia antedating the ocular symptoms may be due to congenital or acquired depigmentation of the blue eye or an abnormal degree of melanin production in the brown eye. In the former case the abnormally depigmented eye may be susceptible to inflammatory and degenerative processes, while in the case of melanosis oculi the brown eye may develop a malignant melanoma. In the present case it would have been especially valuable if it could have been ascertained that the affected eye had always been abnormally dark brown.

On the other hand, heterochromia may develop only in association with an active disease process. If the disease is purely inflammatory, we expect to find depigmentation resulting from destruction of melanoblastic elements in the iris, and the affected eye changes from brown to gray or blue. If the eyes were originally blue and the diseased eye becomes brown, this suggests several possibilities. Hemorrhage into the anterior chamber with deposition of hemosiderin in the iris, or an intraocular ferrous foreign body with subsequent siderosis bulbi could be mistaken for heterochromia due to increased production of melanin. Finally, it is possible that an intraocular melanoma could be associated with a diffuse melanosis leading to a change in iris color from blue to brown.

Now for the autopsy—the external picture was as described clinically with pronounced jaundice and extensive edema of the lower extremities. The organ of principal interest in the general autopsy was the liver which extended 18 cm. below the costal margin. It was tremendous, weighing 7,500 gm. This represents about five times its normal weight. The liver was massively replaced by irregular geographic areas of neoplastic tissue varying in color from very light gray to jet black. None of the other abdominal or thoracic viscera contained any tumor.

The right eye was small, the cornea scarred, and the pupil of pin-point size. Microscopically, definite evidence of a penetrating wound was lacking. There was extensive postnecrotic scarring of the iris and ciliary body. Many macrophages filled with pigment were scattered throughout the iris remnants but no iris tumor was present. The lens was shrunken and calcified along the equator. Broad areas of subcapsular fibrosis were present anteriorly and posteriorly. The totally detached and almost completely necrotic retina together with a large multilobulated tumor mass were adherent to the lens (fig. 1). The lobules of the neoplasm were of varying pigmentation. In some of these, all of the neoplastic cells had become

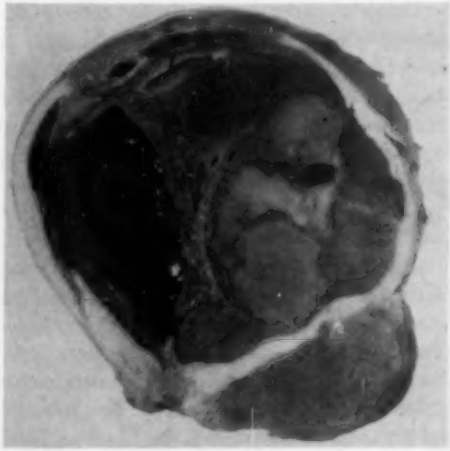

Fig. 1 (Zimmerman and Adler). Case 1, AFIP Acc. 612166. The eye obtained at autopsy has been bisected. Much of the ocular cavity is filled with a largely necrotic, pigmented neoplasm arising in the choroid. The tumor has broken through Bruch's membrane to form a large retrolental mass which displaces the lens (L) and iris almost against the cornea (C). A large posterior episcleral mass of tumor is also evident. (Enlarged 5× actual size.)

necrotic (fig. 2) while in others plump spindle and epithelioid cells remained viable (fig. 3) and exhibited much mitotic activity. Posteriorly, there was an area of scleral necrosis through which the neoplasm extended into the orbit to form a mass measuring five by 10 mm. (fig. 1).

Sections of liver revealed extensive metastasis from the choroidal melanoma, with marked compression and replacement of hepatic tissue (fig. 4).

This case illustrates one of the circumstances under which the presence of a malignant melanoma is often not even suspected. When melanomas become necrotic, the dead tumor tissue excites an inflammatory response that may be as violent as any observed in a bacterial panophthalmitis. We have a number of such cases in the Registry of Ophthalmic Pathology in which the patient has been treated for infection instead

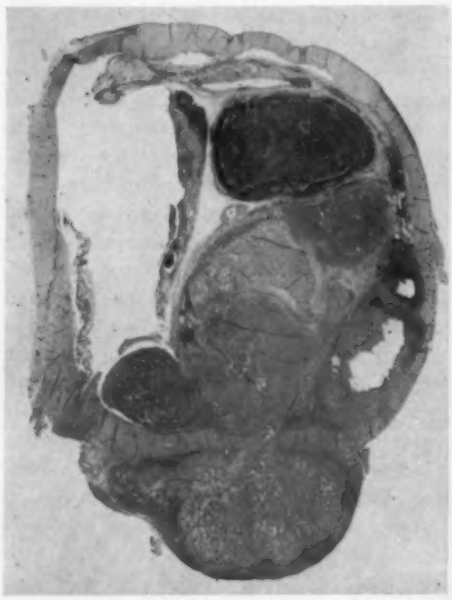

Fig. 2 (Zimmerman and Adler). Case 1, AFIP Acc. No. 612166. Photomicrograph of specimen shown in Figure 1. The pale ill-defined lobules of tumor tissue are completely necrotic. Extensive necrosis is also present in the retrobulbar mass. (Hematoxylin-eosin, ×5.)

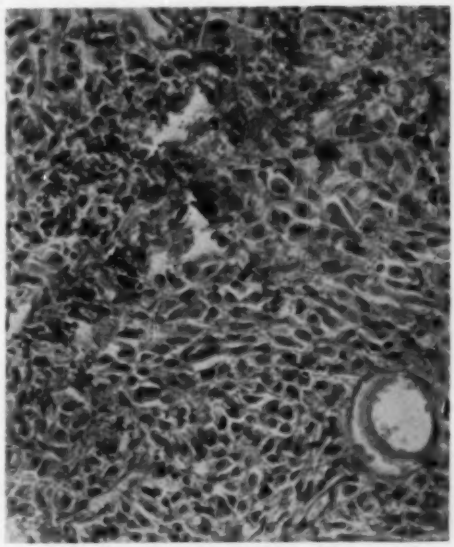

Fig. 3 (Zimmerman and Adler). One of the small areas containing viable neoplasm is illustrated in this field. Most of the tumor cells are of the highly malignant epithelioid type. (Hematoxylin-eosin, ×190.)

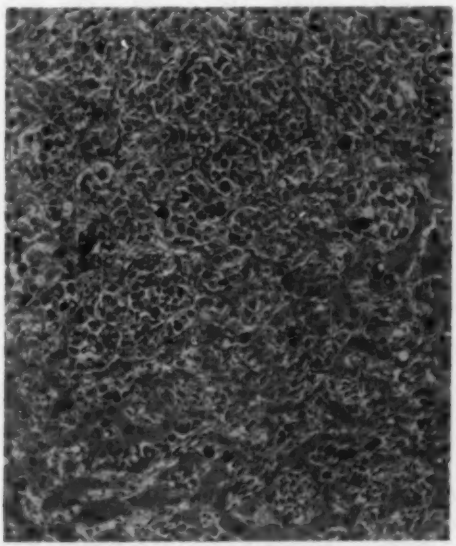

Fig. 4 (Zimmerman and Adler). The liver parenchyma is extensively replaced by the metastatic malignant melanoma. Distorted cords of liver cells are observed in the lower half of the field. (Hematoxylin-eosin, ×90.)

of for tumor. Dr. Reese's book emphasizes quite properly the diagnostic difficulties and poor prognosis in these necrotic melanomas.

Clinical history for Case 2*

A retired officer, 82 years of age, was admitted September 13, 1954, for follow-up examination subsequent to resection of a lymphosarcoma of the cecum in September, 1953. He complained of progressive loss of vision in the left eye of one month's duration.

Past history. He had typhoid and scarlet fevers in childhood. Traumatic arthritis of the knee caused his retirement from the U. S. Army in 1920. Segmental resection of adenocarcinoma of sigmoid colon had been performed in 1942 and right colectomy for lymphosarcoma in 1953. Multiple skin cancers had been excised from his face and neck. Several postoperative ventral hernias and umbilical, inguinal, and hiatal hernias were observed. He also had generalized osteoporosis with compression fractures of several vertebras.

Present illness. The patient stated that since his operation in 1953, his only complaint had been slight gaseous distention after meals until the month before admission when he noted rapid loss of vision in his left eye.

Physical examination. The patient was well preserved, alert, and co-operative and, though he moved cautiously, seemed active for his age. The left lens was cloudy but the right eye appeared normal. There were multiple keratotic lesions over the entire body. The other positive observations were scars related to previous surgical procedures; kyphosis, scoliosis, and a rigid back due to osteoporosis; and multiple hernias.

Hospital course. The patient was admitted to the surgical service where he was found to be in good general condition. Radiographic studies after barium enema and proctoscopy demonstrated no evidence of recurrent or residual tumor. On October 7th, the patient was transferred to the eye service for treatment of a very dense cataract in his left eye and an early senile cataract in his right eye.

On October 12th, following dilation of the left pupil with 10-percent neosynephrine, acute pupillary block glaucoma developed which did not respond to pilocarpine and eserine. He was, therefore, taken to the operating room for emergency sclerotomy and iridectomy. The sclerotomy was made in the pars plana at the 2-o'clock position, seven mm. from the limbus. Considerable liquefied vitreous escaped and this was followed by a bead of formed vitreous. The tension was lowered slightly and iridectomy then performed through a corneoscleral incision. The lens prolapsed into the superior wound margin and anterior chamber. The posterior sclerotomy was widened and more vitreous permitted to escape. Tension did not fall and the intumescent lens delivered itself. This extraction became extracapsular and was followed by a small amount of vitreous loss through the corneoscleral wound. The wound edges were closed and the tension remained elevated. The anterior chamber was flat and a moderate amount of hemorrhage from the sclerotomy site appeared in the vitreous. DFP drops and antibiotics were begun.

The patient had considerable vomiting and ocular pain. On the second postoperative day blood was observed in the anterior chamber. During the next few days the pain and nausea subsided and there was some absorption of blood. On October 19th, the eye seemed to be softer and on October 20th light perception was present. By October 24th, little blood remained, but the cornea was hazy and the fundus could not be visualized. Part of the sutures were removed on October 27th. The cornea was gradually cleared and the tension was controlled with DFP.

By November 8th, light perception was gone but there was no change in the general appearance of the eye. However, on November 12th, signs of endophthalmitis were evident; there was much pain and redness. The eye became very soft and enucleation

* AFIP Accession No. 92025.

was performed on November 19th. A marked inflammatory reaction was present about the globe, in the extraocular muscles, and in the retrobulbar fat.

At the time the left eye was enucleated, there was an early senile cataract in the right eye with vision correctable to 20/30; several tonometric readings were within normal limits.

Differential diagnosis—Case 2

Dr. Adler

This retired officer, aged 82 years, must have been pretty rugged to withstand a resection for lymphosarcoma of the cecum in 1953 and a segmental resection of his sigmoid colon in 1942 for adenocarcinoma, along with excision of multiple skin cancers of the face and neck, multiple postoperative ventral hernias, umbilical, inguinal, and hiatal hernias, generalized osteoporosis with compression fractures of the vertebrae, and finally cataracts.

He evidently had very shallow angles, and as a result of dilation of the left pupil with neosynephrine, developed an acute pupillary block glaucoma. During the iridectomy the lens delivered itself. Possibly it too was aware of Chandler's papers, and thought it would save the operator the trouble. I think we should all be spared the gruesome details of the extraction's becoming extracapsular and being followed by a "small" amount, sic, of vitreous loss through the corneoscleral wound. We cannot ascertain whether the patient had a partial expulsive hemorrhage at this time, or not. We could be merciful and suggest that the whole thing was due to an intraocular extension of his colonic adenocarcinoma or cecal lymphosarcoma. I rather suspect, however, that these were not found histopathologically.

Question. Do you believe the story of the cataract's developing in a period of only one month is especially significant?

Dr. Adler: No, I would guess that history is unreliable.

Question: Could this patient have a primary intraocular tumor?

Dr. Adler: Yes, and if I were playing poker that would be my diagnosis since I believe Dr. Zimmerman will want to show us something more than just complications of ocular surgery.

Pathology and discussion—Case 2

Dr. Zimmerman

Seldom do we receive as much general medical history along with enucleated eyes contributed to the Registry of Ophthalmic Pathology as we did in this case.

The clinical diagnosis at time of enucleation was "endophthalmitis, left eye, secondary to glaucoma and extraction of intumescent cataract." The eye when received in the laboratory was still of normal size but it showed opacification of the cornea, scarring of the superior limbus, and areas of episcleral thickening. The anterior chamber was obliterated by a mass of tissue which included portions of iris, ciliary body, lens capsule, hemorrhagic inflammatory tissue,

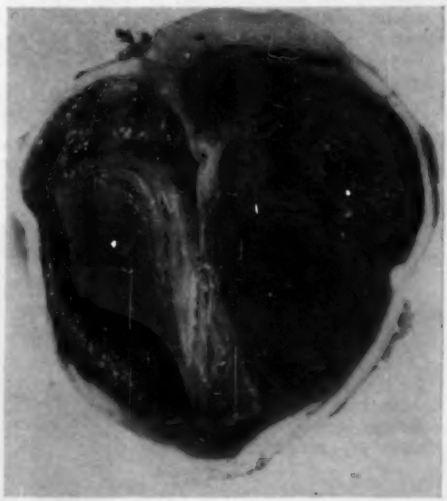

Fig. 5 (Zimmerman and Adler). Case II, AFIP Acc. 92025. A large, deeply pigmented, very necrotic tumor arising in the choroid and ciliary body has invaded the anterior segment to form a mass just behind the cornea. There is marked disorganization of intraocular structures with complete retinal separation. The lens has been removed. An arrow indicates the operative site. (Enlarged 6× actual size.)

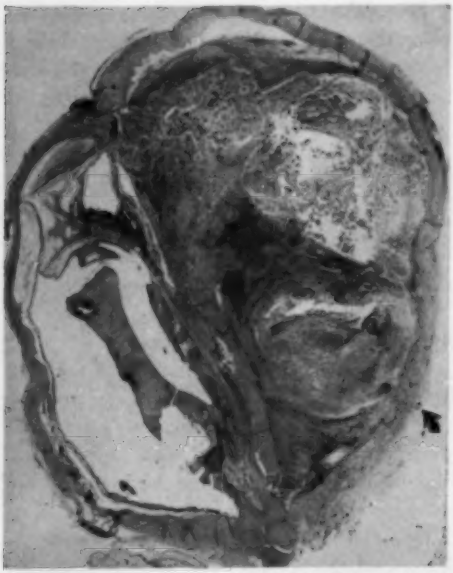

Fig. 6 (Zimmerman and Adler). Photomicrograph of eye shown in Figure 5. The extensive necrosis within the neoplasm and the disorganization of internal architecture are evident. The sclera adjacent to the melanoma shows inflammatory changes induced by the necrotic tumor. A small island of episcleral tumor (arrow) is shown at greater magnification in Figure 7. (Hematoxylin-eosin, ×6.)

and necrotic tumor (figs. 5 and 6). The deeply pigmented neoplasm arose from the ciliary body and choroid but broke through into the vitreous and anterior chambers. The retina was completely detached. Very little viable neoplastic tissue remained, and again, as in Case 1, there was evidence of the toxic effect of the necrotic tumor. The sclera and episclera were edematous and infiltrated by chronic inflammatory cells. A small focus of viable tumor was observed in the episclera (fig. 7).

One reason this case was selected was to provoke a discussion of multiple tumors. There has been a growing interest in the problem of multiple cancers and some speculation as to whether this problem will become more important clinically as our life expectancy increases. Autopsies on octogenarians not infrequently disclose multiple benign and malignant tumors which may or may not have played any role in the patient's clinical course. Various studies have not yielded consistent conclusions. Estimates vary from no increase at all to a three- to tenfold increase in susceptibility to cancer among those who already have had a malignant tumor removed.[2,3] Patients with breast, colonic, and skin cancers are likely to develop new tumors *of the same type* but they are probably *no* more susceptible to other kinds of neoplastic disease. We may, therefore, conclude that in this second case, the patient had a most unusual tendency to develop multiple cancers and that the mere

Fig. 7 (Zimmerman and Adler). Episcleral extension of malignant melanoma is seen at right of field. Most of the intraocular tumor (left of field) is completely necrotic. (Hematoxylin-eosin, ×36.)

fact that he had already had several other neoplasms made him no more likely to have a malignant melanoma as the cause for his cataract.

A brief statement should be made about intraocular metastasis from distant primaries. The one cancer which does show some tendency to metastasize to the eye is the breast carcinoma of women, and it may do so even after the patient has survived five years and is apparently cured of her disease. Most other tumors that metastasize to the eye do so only infrequently and the ocular manifestations in these cases usually are not of clinical importance since the patient is likely to be dying of widespread cancer at the time he first shows signs of ocular involvement.

Finally, I would like to emphasize the main point illustrated by these two cases. In a patient with a cataract, the appearance of signs of endophthalmitis or panophthalmitis should lead one to suspect malignant melanoma. All too often the differential diagnosis seems to begin and end with infection. Remember that a necrotic neoplasm can evoke all of the cardinal signs of inflammation.

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RETINITIS PIGMENTOSA, OPHTHALMOPLEGIA, AND SPASTIC QUADRIPLEGIA*

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Retinitis pigmentosa has from time to time been associated with disorders of the central nervous system. However, a survey of the literature reveals that retinitis pigmentosa associated with a disturbance of the central nervous system, and in addition, ophthalmoplegia, have been reported only by Ford,[1] Walsh,[2] Barnard and Scholz,[3] and Chamlin and Billet.[4]

In these cases, the retinitis pigmentosa may be of the typical variety, the two essential features of which, according to Duke-Elder,[5] are: attenuation of the retinal vessels and bone corpuscle type of pigmentary changes; or the atypical variety, whose clinical manifestations may include (1) central pigmentary degeneration, (2) degeneration sine pigmento, and (3) acute pigmentary degeneration.

In his textbook on pediatric neurology, Ford,[1] lists the following neurologic conditions which may be associated with pigmentary changes in the retina: (1) Lawrence-Moon-Biedl syndrome, (2) cerebellar ataxia, (3) cerebellar ataxia and spastic paraplegia, (4) spastic paraplegia and deafness, (5) muscular atrophy and deafness, (6) progressive dementia, (7) extrapyramidal rigidity (degeneration of the globus pallidus of Winkleman), (8) progressive nuclear ophthalmoplegia, (9) progressive

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nerve deafness, cerebellar ataxia and polyneuritis, and (10) progressive nerve deafness.

According to Wilson-Kinnier,[6] retinitis pigmentosa may be associated with deaf mutism, color-blindness, Leber's optic atrophy, Paget's disease, and the Hallervorden-Spatz syndrome (progressive muscular rigidity and contractions, dysarthria, and blindness from retinitis pigmentosa).

Duke-Elder[5] states that cerebellar ataxia, pigmentation of the skin, and other skeletal and organic anomalies have been reported as having been associated at times with retinitis pigmentosa.

The Lawrence-Moon-Biedl syndrome[7] is characterized by pigmentary degeneration of the retina, mental deficiency, obesity, defective sexual development, and often polydactylism. Hutchinson,[8] under whose care the original cases reported by Lawrence and Moon later came, reports that these cases of retinitis pigmentosa eventually developed a spastic paraplegia.

According to Ford,[1] Stewart[9] described cerebellar ataxia in two sisters, associated with pigmentary degeneration of the retina and mental deficiency. Frement, Bennet, and Colrat[10] studied a family in which both cerebellar ataxia and spastic paraplegia developed in association with pigmentary degeneration of the retina in several generations. The neurologic picture was not unlike that seen in cases of multiple sclerosis.

Zonca[11] described two cases in which a neurologic picture similar to that seen in Friedreich's ataxia was associated with retinal pigmentary degeneration. Friedreich's ataxia is a heredofamilial disorder of the central nervous system characterized by a progressive degeneration of the spinocerebellar tracts, the corticospinal tracts, and the posterior columns of the cord. The diagnosis is based on the physical signs of (1) cerebellar ataxia such as the characteristic cerebellar gait, ataxia in the finger-nose and the heel-knee tests, disturbances in speech, and nystagmus; (2) involvement of the posterior columns of the spinal cord such as loss of proprioception, a tabetic type of gait, and a positive Romberg sign; (3) pyramidal tract disease which may be so marked by the other lesions that only a bilateral extensor response may be elicited; (4) loss of tendon reflexes and characteristic deformities of the feet and spine.

Ford[1] further reports that Clauss[12] found a progressive spastic paraplegia in association with deafness and pigmentary degeneration of the retina. Muscular atrophy and flaccid paralysis were described by Ruggeri[13] in a patient with pigmentary retinal degeneration, deafness, and mental deterioration.

Von Stoch[14] reported that dementia without neurologic signs may occur in association with pigmentary degeneration of the retina and may run a rapid course. Degeneration of the globus-palidus and substantia nigra with progressive muscular rigidity and pigmentary degeneration of the retina were described by Winkleman. Refsum[15] et al. described the condition of four children who developed, between the age of four and seven years, nerve deafness, atypical retinitis pigmentosa with night blindness, ichthyosis, ataxia of the cerebellar type, polyneuritis with loss of deep reflexes, and an increase in the protein content of the spinal fluid but no mental deterioration. Degenerations were found in the peripheral nerves, the anterior horn cells of the spinal cord, and the olivocerebellar tracts. Fat was found in the nerve cells and ependyma.

Of those cases of retinitis pigmentosa associated in some cases with disease of the central nervous system and in addition ophthalmoplegia reported by Ford,[1] Barnard and Scholz,[3] and Walsh,[2] only the patient reported by Walsh is similar to the one to be reported here, in that the patient showed the triad of retinitis pigmentosa, ophthalmoplegia, and spastic quadriplegia.

The case reported by Ford[1] was that of a girl who was apparently normal until the age of nine years. At that time the patient's mother noticed that her right eyelid was

drooping and later the left eyelid was similarly affected. Examination at the age of 12 years revealed a bilateral ptosis with pigmentary changes in the periphery of both retinas. The injection of Prostigmine was ineffectual. Ophthalmologic and neurologic examinations were otherwise negative. Re-examination at the age of 15 years showed a definite increase in the ptosis with definite limitation of all ocular movements of both eyes. The pupils still reacted well and central vision was preserved.

Barnard and Scholz[3] reported four cases of various types of retinal degeneration complicated by ophthalmoplegia. In all of their cases, however, other factors such as post-thyroid state, syphilis, or microcephaly were present which might have possibly accounted for the ophthalmoplegia. Nevertheless, the authors felt that in these cases the ocular muscle palsies and retinal degeneration appeared to be more than a coincidence; and suggested the possibility that degeneration in the retina and in the nerves to the extra-ocular muscles may be a syndrome due to some common factor. Their cases follow:

Case 1 was that of a 43-year-old white woman who at the age of five years had developed a left facial paralysis and a convergent strabismus following a convulsion. At 33 years of age her vision began to fail in both eyes. At 34 years a thyroidectomy was performed, following which a questionable proptosis of the left eye was observed. Three years later, although there was no perceptible exophthalmos, the fissures were abnormally wide and there was a lid lag. At this time there was also partial limitation of all movement of the right eye and limitation of downward movement in the left eye. After cataract extraction in the right eye, the fundus showed a pale optic disc, narrowed retinal arteries, and numerous deposits of pigment throughout the fundus, giving a typical picture of retinitis pigmentosa. The left fundus could not be visualized because of an opaque lens. The possibility of this being a thyrotropic exophthalmos must be considered.

Case 2 was that of a 31-year-old Negress who had received inadequate therapy for a positive serologic test for syphilis and who gave a history of decreasing vision associated with diplopia of one year's duration.

There was a bilateral external ophthalmoplegia, complete except for the superior oblique muscles. There was a slight downward movement of the eyes bilaterally, but no voluntary motion upward. Bell's phenomenon was present. At rest there was a bilateral ptosis. The pupils were round, regular, and equal and reacted normally to light and accommodation. Convergence was poorly performed. Confrontation visual fields were normal. The optic discs and vessels were normal. The retina was normal except in the extreme periphery where there were numerous scattered corpuscularlike deposits of pigment. The remainder of the neurologic examination revealed no abnormalities. Injection of Prostigmine produced no change in the ocular muscle picture. The possibility that the fundus picture in this case was one of a peripheral luetic chorioretinitis is difficult to exclude.

Case 3 was that of an 18-year-old Negress who was first seen for the treatment of a positive serology. Physical examination was normal. Fundi showed bilateral optic atrophy with a marked attenuation of the retinal arterial tree. The macula was the site of extreme degeneration bilaterally and there was a hole in the center of each area of degeneration. The entire retina appeared atrophic, having a greenish, fluorescent sheen due to diffuse fine pigmentary stippling. In the extreme periphery a few heavy deposits of pigment were seen. Vision was reduced to light perception in each eye. The pupils were dilated and reacted slowly and incompletely to light. There was no movement of either eye in any direction, either on voluntary effort, in response to caloric stimulation of the vestibular apparatus, or on Bell's maneuver. The left eye looked forward, the right down and out. There was a slight weakness and marked spasticity of all four limbs. There were no involuntary movements, fibrillations, or muscular atrophy. Speech was slow, monotonous, and labored. No sensory disturbances could be found. All deep reflexes were hyperactive and there was a bilateral Babinski response. She appeared retarded mentally. Later she developed bilateral atrophy and fibrillation of the tongue.

Case 4 was that of a 31-year-old white man who complained of difficulty in speaking, poor hearing, and an inability to raise his eyelids or move his eyes. At the age of 12 years it was noted that he was hard of hearing and that his vision was defective. At the age of 14 years, his speech became defective and at 27 years he developed a bilateral ptosis. At the age of 28 years ataxia appeared.

Neurologic examination showed the patient to be poorly developed with a slender bone structure. The head was microcephalic with a high vertex. Vision was 10/200 in the right eye and 20/50 in the left. The pupils were large and reacted sluggishly to light. There was a bilateral ptosis and loss of all ocular movements. The patient had severe bilateral nerve deafness. The rest of the cranial nerves were intact. There was no muscular atrophy. There was oscillation of the head and trunk, with cerebellar ataxia in the arms and legs. Speech was indistinct and slow. The tendon reflexes were all active and equal. External examination of the eyes revealed a partial bilateral ptosis. The ocular movements were limited to excursion of about four degrees in each direction and con-

vergence was absent. In the right eye, the disc appeared of good color but was surrounded by a whitish ring about one-fourth disc diameter across with a very slight pigmentary disturbance. There was a generalized diffuse degeneration throughout most of the retina, most marked in the macular regions, consisting of a strippled appearance with a fine pigmentary disturbance. In the far periphery there was a general lack of retinal pigment so that the choroidal vessels were plainly seen. The retinal vessels appeared essentially normal. Roentgenograms of the sinuses, optic foramina, and sella turcica were normal. Blood serology was normal.

From these cases Barnard and Scholz suggested that the two constant features ophthalmoplegia and retinal degeneration with pigmentary changes may be a syndrome due to some common etiologic factor.

The following cases were reported by Walsh:[2]

Case 1 was that of a 24-year-old woman who had noticed for about six years that she was unable to look to either side without turning the head. No diplopia was present. There was no ptosis and the eyes could be moved freely downward. Lateral movements were three to 15 degrees. Each eye could be moved internally 10 degrees and upward about five degrees. On moving the eyes laterally the visual axis remained parallel with the abducted eye alone completing the movement for a further five degrees. Visual acuity was normal for each eye. Ophthalmoscopic examination revealed pigmentary deposits along the vessels in the peripheral retinas. The vessels were normal. The visual fields were normal for form and colors. Neurologic and general examinations were negative.

Case 2 was that of a 12-year-old girl in whom a nuclear ophthalmoplegia appeared at the age of eight years. At the age of 12 years there was a bilateral ptosis most marked on the right side, and extraocular movements were limited in all fields. There was questionable pallor of the optic discs with only slight attenuation of the retinal arterioles. There were pronounced pigmentary changes in the peripheral fundus without typical bone corpuscle formation. General physical and neurologic examinations were negative.

Case 3 was that of a 13-year-old girl who showed bilateral ptosis associated with almost complete immobility of the eyes. There was pronounced pigment mottling throughout each fundus without there being typical deposits of pigment along the vessels. The vessels seemed to be quite normal and general and neurologic examinations were negative.

Case 4 was that of a 30-year-old white man who began having some difficulty with hearing at age of 13 years, defective speech with a reduction in visual acuity at 14 years, and ataxia and bilateral ptosis at the age of 26 years. Neurologic examination revealed a bilateral reduction of visual acuity, and almost total paralysis of the third, fourth, and sixth nerves with normal pupillary reactions. There was severe nerve-type deafness and speech was indistinct and slow. There was a pronounced cerebellar type of ataxia in the arms and legs. The fundi were diffusely pigmented and the arteries were within normal limits as to size, although possibly slightly on the small side. There was a small posteriorally situated lens opacity in each eye. The visual fields were full for form and within normal limits for colors.

Case 5 was that of a 25-year-old Negress who, when first examined at the age of 17 years for treatment of a positive serology, complained of an unsteadiness of gait. Eight years later when reexamined she showed an unsteady gait, speech difficulty, and was thought to be blind. All four extremities were spastic. There was a divergence of the visual axis. The pupils were round, equal, and fixed to light. She was unable to move her eyes in any direction. The optic discs were extremely pale; there was hole formation in each macula; the ves-

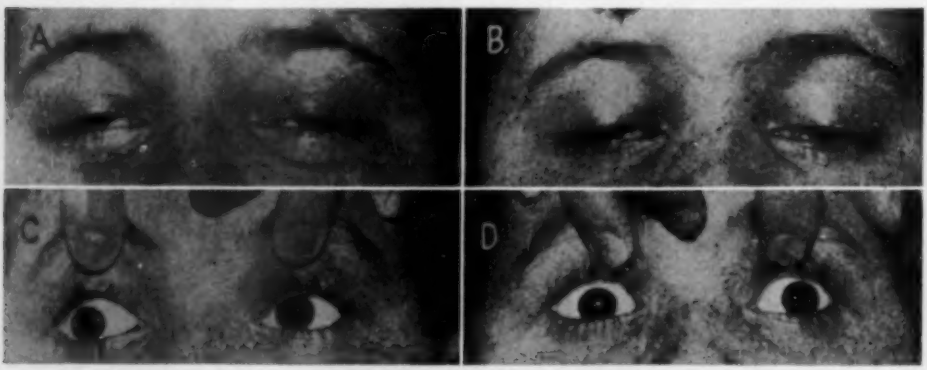

Fig. 1 (Alfano and Berger). Case 1—Chamlin and Billet.[4] (A) Direct view. (B) Patient attempting to raise the lids. (C) Patient attempting right lateral gaze. (D) Patient attempting left lateral gaze.

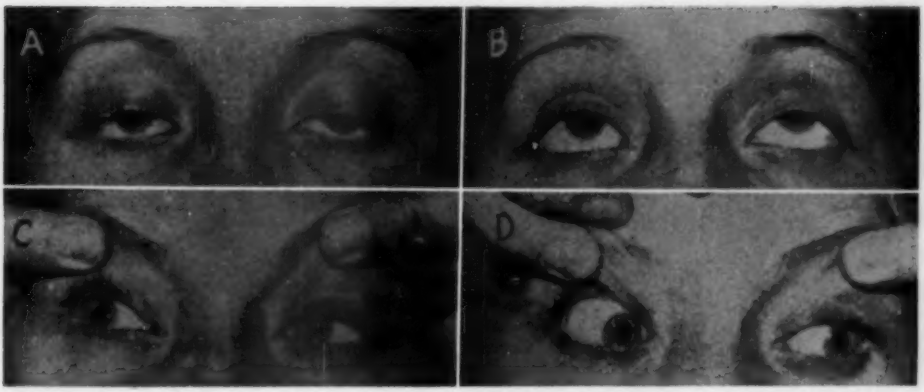

Fig. 2 (Alfano and Berger). Case 2—Chamlin and Billet.[4] (A) Direct view. (B) Patient attempting upward gaze. (C) Patient attempting right lateral gaze. (D) Patient attempting left lateral gaze.

sels were extremely attenuated and in the peripheral portion of each retina there were fairly typical pigment deposits.

Three cases of ophthalmoplegia and retinal degeneration were also reported by Chamlin and Billet:[4]

Their first case (fig. 1) was that of a 13-year-old boy who complained of difficulty in opening his eye for two years. Physical examination was noncontributory except for short stature and a lack of gonadal development for a boy of his age. Ptosis was almost complete in both eyes and ocular motility was restricted in all directions. On attempted right lateral gaze the right eye rotated only 15 degrees and the left eye 30 degrees. Upward gaze was present but limited. Both fundi showed irregularly distributed pigment granules in the macular area, as well as throughout most of the periphery. The discs were of normal color and the vessels of normal caliber. The peripheral fields for 2/330 white showed slight peripheral contraction.

Their second case (fig. 2) was that of a 14-year-old white girl whose past history revealed an insidious, progressive onset of ptosis two years before. The right pupil was slightly larger than the left and reacted consensually but not directly to light. Ocular motility was restricted. On attempted left lateral gaze, the right eye was able to adduct 25 degrees and the left eye abducted 30 degrees. On attempted right lateral gaze, both eyes rotated only 25 degrees from the midline. Examination of the right fundus showed definite swelling of the disc with blurred margins and distended veins. Several small linear hemorrhages were seen coming off the disc and the retinal arteries were slightly narrowed. The disc and vessels in the left eye were normal in appearance. Throughout both fundi, especially peripherally, there were irregular areas of pigmentary retinal degeneration, manifested by yellowish mottling with fine and coarse pigment deposits. No definite formation of bone corpuscles was present, rather the picture resembled a fundus of the salt-and-pepper type. A diagnosis of optic neuritis in the right eye was made. Skull X-ray studies were normal, as were serologic tests for syphilis.

Case 3 (fig. 3) was that of a 26-year-old white woman who gave the history that, at the age of 13

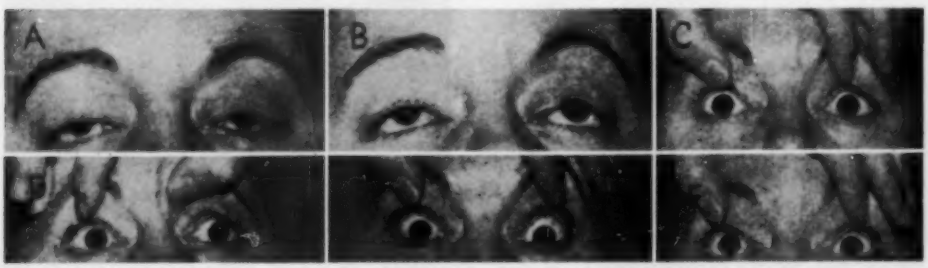

Fig. 3 (Alfano and Berger). Case 3—Chamlin and Billet.[4] (A) Direct view. (B) Patient attempting to raise eyelids. (C) Patient attempting right lateral gaze. (D) Patient attempting left lateral gaze. (E) Patient attempting downward gaze. (F) Patient attempting upward gaze.

Fig. 4 (Alfano and Berger). Marked spasticity of both hands and upper extremities. Lower extremities were equally as spastic.

years, both upper lids began to droop. Examination revealed almost total external ophthalmoplegia. Throughout both fundi were seen scattered areas of pigmentary disturbance but no bone corpuscle clumps. While some of the pigmentary changes were near the disc, most of them were at the periphery. There was no contraction of the visual field. In addition to the ocular changes, the patient showed some difficulty in talking and swallowing indicative of bulbar palsy.

Case report

A 37-year-old Negress was well until the age of 27 years at which time she began experiencing acute recurrent occipital headaches. At the time of admission she gave a history of having difficulty in walking for 11 years, total loss of vision for seven years, and difficulty with speech for five years.

Past history revealed that she had had the usual childhood diseases. Venereal diseases were denied and she had had no accidents or surgical procedures. She had lost about 30 lb. in weight during the past five years. The patient had a 16-year-old daughter.

Physical examination revealed a somewhat undernourished, slightly euphoric Negress who was in no distress. Examination of the head, neck, chest, abdomen, and pelvis were negative. All four extremities (fig. 4) were spastic and difficult to manipulate.

The neurologic consultant stated that the patient was affable, almost euphoric, with apparently normal intelligence. Cranial nerves I and II and VII through XII were normal. Examination of the deep reflexes revealed a 4-plus hyperactivity. All extremities were spastic with a marked ankle clonus bilaterally. There was also clonus on testing the biceps reflex. There was a bilateral positive Hoffman's sign with an equivocally positive Babinski on the left side. Abdominal reflexes were absent. Examination of the sensory apparatus revealed normal position and vibratory sense. Sense of touch and pain were normal. Motor power was recorded as fair and there was some weakness in the lower extremities. Co-ordination appeared impaired in proportion to motor weakness. A Romberg test could not be performed as the patient was unable to stand. The finger to nose test was performed fairly well. The palms of the hands were somewhat atrophied.

Laboratory examinations revealed negative blood and spinal fluid studies for lues. Lumbar puncture revealed a clear spinal fluid with no cells. The pressure was not elevated and a Pandy test was negative. Spinal fluid chemistry revealed a glucose of 82 mg. percent (50-70 normal), protein 12 mg. percent (20-50 normal), and chlorides of 116 mg. percent (115-130 normal).

White blood cell count was 6,600 hemoglobin 80 percent, and the platelet count was normal. Blood chemistry revealed a normal NPN and total protein. However, there was a reversal of the A/G ratio. Alkaline phos-

Fig. 5 (Alfano and Berger). Eyes in the primary position, showing a wide divergence of the visual axis. Because of bilateral partial ptosis, the lids had to be elevated manually.

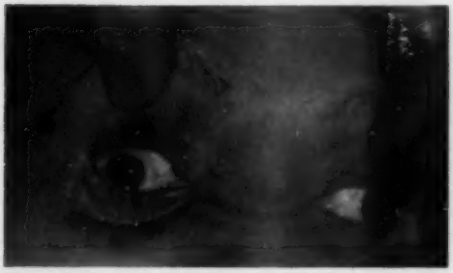

Fig. 6 (Alfano and Berger). Right lateral gaze, showing slight further abduction of right globe with an inability to adduct the left globe.

Fig. 8 (Alfano and Berger) Upward gaze showing inability to elevate globes.

phatase was normal as was the gamma globulin turbidity test.

Eye examination. The patient could not perceive light in either eye, and the pupils were semidilated and fixed. There was no ptosis, and the eyes were widely divergent (fig. 5).

On right lateral gaze there was a slight jerky movement of the right lateral rectus and the left eye failed to adduct (fig. 6). On the left lateral gaze there was a slight jerky movement of the left lateral rectus and no adduction of the right medial rectus (fig. 7). Straight upward gaze was not possible (fig. 8) and straight downward gaze (fig. 9) revealed a marked paresis of the depressors. On attempted looking up and to the right, it was found that there was no action of the right superior rectus. Since adduction of the left eye was not possible the left eye could not be brought into the field of action of the left inferior oblique and hence this muscle could not be tested. On attempted looking up and to the left, there was no action of the left superior rectus and, since the right eye could not be adducted, the right inferior oblique could not be tested. Upon looking straight down (fig. 9) there was only slight movement of the right eye and almost none in the left, indicating a paresis of right inferior rectus and a paralysis of the left inferior rectus. Convergence was not possible and since neither eye could be adducted the superior oblique muscles could not be tested. Bell's phenomenon was absent. Rotating the head to the right (doll-head phenomenon) produced slightly further abduction of the left eye but no adduction of the right. Rotation of the head to the left produced slightly further abduction of the right eye but no adduction of the left eye.

Corneal sensation was normal. Examination of the fundi revealed clear lenses which showed no evidence of a posterior polar opacity. The vitreous was clear. Examination

Fig. 7 (Alfano and Berger). Left lateral gaze, showing slight further abduction of left globe, with an inability to adduct the right globe.

Fig. 9 (Alfano and Berger). Downward gaze showing slight depression of right globe and almost no depression of left globe.

of the discs revealed them to be orange-yellow in color with a physiologic cupping. One could not call these discs atrophic. All of the retinal arteries were so markedly attenuated that they appeared as very thin delicate threads. The veins also appeared attenuated but were wider in caliber than the arteries. In some areas the vessels were irregularly streaked with black pigment.

The entire macular areas were of a grayish yellow color. There were fine brownish striae radiating outward from the maculas and there were fine pigmented dots scattered throughout. In the fovea and adjacent to it was an accumulation of pigment dots which had replaced the fovea proper. The macular areas had a salt-and-pepper appearance. Beyond the maculas there was an apparently normal equatorial zone. Beyond the equatorial zone in the periphery of the fundi, most marked in the superior temporal quadrants, were multiple irregularly circumscribed areas of choroidal atrophy varying from one-quarter to one-half disc diameter in size which were irregularly bordered by and sparsely covered with black pigment. There were also larger areas of black pigment spots scattered throughout the peripheral fundus which were of the bone-corpuscle variety.

Discussion

It was apparent that in regard to the bilateral nuclear ophthalmoplegia involving the oculomotor nerve in the right eye, the superior rectus and medial rectus were completely paretic, whereas the inferior rectus was only partially involved. In the left eye the superior, medial, and inferior rectus were completely paretic. Because of the inability to adduct either eye the inferior and superior oblique muscles could not be tested.

Convergence was not possible. This undoubtedly was due to the fact that both medial recti were also paretic.

The negative Bell's phenomenon substantiates the diagnosis of a nuclear paralysis of the superior recti for, if the Bell's phenomenon is mediated by impulses passing from the seventh nerve nuclei through the posterior longitudinal bundle to the third nerve nuclei, the eyes would have deviated upward had that portion of the third nerve nucleus supplying the superior rectus been functioning. Since in the abducted position the inferior oblique does not act as an elevator of the globe, the absence of the Bell's phenomenon gives us no information about the condition of the nuclear cells supplying this muscle.

The failure of right eye to adduct upon turning the head to the right and also the failure of the left eye to adduct upon turning the head to the left indicate nuclear paresis of the medial recti. This reflex is probably mediated through the following pathway: Turning the head to the right initiates an impulse in the right semicircular canals which is caught up in Scarpa's ganglion. From this ganglion the impulse passes along the vestibular nerve to the vestibular nucleus in the pons. From the pons the impulse passes into the posterior longitudinal bundle from where the impulse passes to the nucleus of the left abducens nerve and simultaneously to the right third nerve nuclear cells supplying the right medial rectus.

This movement thereby produces a reflex conjugated deviation of the eyes to the left. When the head is turned to the left, a conjugate deviation of the eyes to the right is accomplished by the same mechanism excepting that the impulse originates in the left semicircular canal and passes to the appropriate oculomotor nuclei. Since turning the head to the right failed to produce an adduction of the right medial rectus and turning of the head to the left failed to produce adduction of the left medial rectus, we can conclude that the nuclear cells of the oculomotor nerve supplying both medial recti were not functioning.

From a description of the fundus, it was apparent that this patient presented the retinal picture of a central pigmentary degeneration. In speaking of central pigmentary

degeneration of the retina Duke-Elder[5] states: the pigmentary disturbance appears as spiderlike clumps or scattered black dots, taking the form of an island round the macular area. The epithelial disturbance is frequently associated with a subadjacent choroidal sclerosis which may be sharply defined or merge gradually into apparently normal tissue, to be again succeeded by an equatorial belt of typically pigmented retina. In these cases central vision is much damaged and the patient may prefer a dull light to a bright illumination.

Although the fundus picture described fits well into the diagnosis of an atypical retinitis pigmentosa, we were struck by the similarity of the pigment spots in the macular area in this case with the pigment spots seen in the macular area and fovea in cases of cerebromacular degeneration. The possibility of this clinical picture of atypical retinitis pigmentosa, nuclear ophthalmoplegia, and spastic quadriplegia belonging to the group of cerebromacular degenerations is entertaining.

It is thought that the cerebromacular degenerations including Tay-Sachs disease and the late infantile, juvenile, and adult forms of cerebromacular degeneration are due to faulty metabolism of fat with the resulting deposition of lipoid materials in the cells of the central nervous system.

Since the macular picture in this case resembles those seen in cases of cerebromacular degeneration, it is possible that this triad of central (atypical) pigmentary degeneration, nuclear ophthalmoplegia, and spastic quadriplegia may be an adult form of cerebromacular degenerations, in which lipoid materials are deposited in the retina, oculomotor nuclei, and the cerebrum. In the cases reported by Refsum,[15] fat was found in the nerve cells and ependyma.

Conclusion

Those neurologic conditions which have been reported as associated with pigmentary degeneration of the retina were reviewed. Twelve cases of retinitis pigmentosa associated with nuclear ophthalmoplegia collected from the literature were also presented. In one of these cases, reported by Walsh, the patient showed the triad of retinitis pigmentosa, ophthalmoplegia, and spastic quadriplegia similar to the case reported herein.

It is brought out that in the case reported by us, the macular picture was not unlike that seen in cases of cerebromacular degenerations.

The possibility that this triad of signs—retinitis pigmentosa, ophthalmoplegia, and spastic quadriplegia—belongs to one of the groups of degenerative diseases, perhaps associated with abnormal lipoid storage, is entertaining. All patients with retinitis pigmentosa probably should receive a complete neurologic survey and, similarly, all patients with oculomotor nerve ophthalmoplegia should have a careful examination of the fundus, particularly the periphery, for evidence of pigmentary changes.

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HEREDITARY CHARACTERISTICS OF RETINOBLASTOMA*

With the report of an affected family

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The following report of a family in which four members were affected with retinoblastoma is presented partly for the record and partly to emphasize the fact that these tumors may have an hereditary tendency. Several family histories illustrating this latter point have been reported, and the literature has been reviewed several times.[1-9] Sorsby[10] has pointed out that, whereas originally it was felt the transmission is recessive, these reports have shown it to be dominant.

The four affected members in the present family have the following histories:

1. The first patient, a little girl, was referred to me in July, 1951, at the age of 22 months with a diagnosis of retinoblastoma endophytum in the left eye. Her history of a white pupil and defective sight preceded this by about six weeks. The left eye was enucleated, and while she was under the anesthetic the right eye was examined. Two small retinoblastomas of the endophytum type were seen at the posterior pole of this eye. A week later radon seeds were implanted on the sclera over the tumors. However, the eye did not do well and had to be enucleated in September, 1951. Since then the patient has remained in good health and there has been no evidence of recurrence.

2. The sister of the first patient was brought to me in October, 1952, at the age of seven months with a statement by the mother that the child's right eye was beginning to look like her sister's eyes. On examination under a general anesthetic, a slightly raised pale mass was noted at the posterior pole of the right eye. The retina was somewhat edematous and detached over it. A diagnosis of retinoblastoma exophytum was made and the eye was enucleated three days later. The patient has been examined at intervals since that time. There has been no recurrence in the region of the right eye, and the left eye has remained normal.

In December, 1955, two brothers, the first cousins of the first two patients, were admitted to the Hospital for Sick Children, Toronto, for treatment of intraocular tumors. I am grateful to Dr. Lloyd Morgan and his

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* From the Departments of Ophthalmology of the Royal Victoria Hospital and McGill University. Presented at the annual meeting of the Canadian Ophthalmological Society, Quebec City, Quebec, June, 1956.

staff, particularly Dr. Arstikaitis, for their permission to present the clinical data on these cases and for the related pathologic material.

3. The younger of the two boys was referred to the Hospital for Sick Children early in December, 1955, at the age of six and one-half months. Just a few days previously his family doctor had noticed that the left pupil had a yellowish reflex. At examination in the hospital, a large retinoblastoma endophytum was found at the posterior pole of the left eye, and another somewhat smaller one of the same type at the temporal periphery of the right retina. As it was felt that both tumors were too large for conservative treatment both eyes were enucleated.

4. The older of the two boys, who was just three years old, volunteered no history and he had no complaints. A careful intern examined him at the time his brother was admitted. A retinoblastoma endophytum was found at the posterior pole of the right eye, and a few days later the eye was enucleated. The left eye was examined carefully. There was no apparent involvement.

To date there has been no evidence of recurrence in either child, and the remaining eye in the older brother has continued free of tumor.

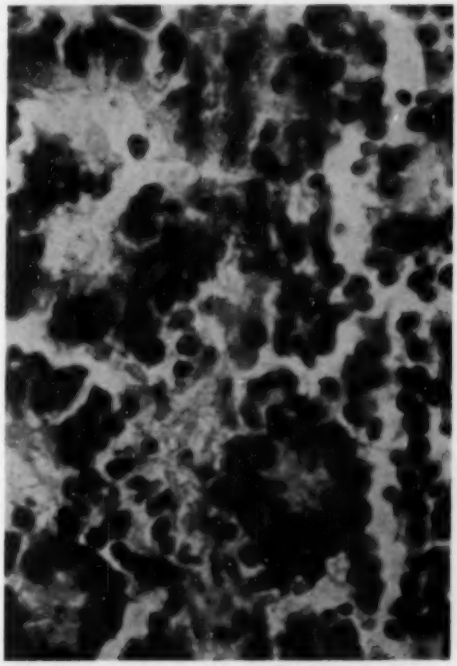

Fig. 1 (Nicholls). Patient 1. Left eye. (Hematoxylin-eosin ×600.) Showing mature neuroepithelioma type of cells with well-developed rosette formation.

Pathologic findings

The tumors occurring in these four patients showed some similarities and some differences. They all contained densely packed, irregularly arranged round cells with dark, round nuclei and scanty cytoplasm. Mitotic figures were seen here and there. These were more common in Patients 2 and 4. The cells obviously were primitive retinoblastoma cells. However, in some areas, the cells were more differentiated and were of the typical neuroepithelioma type. These latter frequently were arranged in the form of rosettes. This type of cell and arrangement was commonest in both eyes of Patient 1 (fig. 1), and in the left eye of Patient 3, less common in the latter's right eye (fig. 2), and almost absent in Patients 2 and 4. The cells were lying in a very delicate and scanty reticulum. The tumor masses were relatively avascular. Granular necrosis occurred in some areas, far removed from the vessels. All this, of course, is a typical picture.

Hereditary characteristics

In Figure 3, the family tree of these patients is presented. It has been possible to trace the family back to the great grandparents. The grandmother lost her right eye at the age of three years. According to the family's story the eye had to be enucleated as the result of an injury. This was carried out in England. The most careful search has failed to uncover more data. The grandmother's parents were well and had intact eyes. The grandfather's eyes were quite normal.

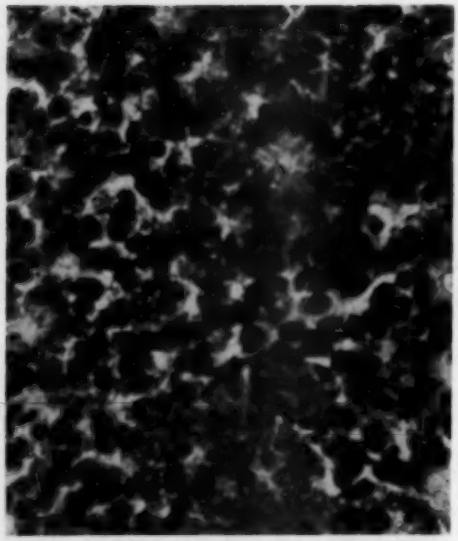

Fig. 2 (Nicholls). Patient 3. Right eye. (Hematoxylin-eosin, ×600.) Showing a mixed picture, with immature neuroblastoma cells predominating and a few poorly formed rosettes.

The grandparents had nine children, five boys and four girls. These children, all born in Canada, are still alive except for the first boy. All except for this boy have intact eyes. He died at the age of three years as the result of a cancer of the right eye, as reported by the family and in the death certificate. The right eye was enucleated at his home and, thus, there is no hospital report. Unfortunately, his attending doctors are now dead making a report from this source impossible. Later he lost the sight of his left eye. There was some postoperative infection in the right socket but none in the left eye. It is quite safe to assume that this child had had a retinoblastoma in the right eye and possibly also in the left eye.

Not illustrated in Figure 3 are the families of the mothers of the affected children. They have been traced back to their fathers, uncles, and aunts, and also along collateral lines. No evidence of retinoblastoma in any member of these families has been found.

Discussion

In the pathologic pictures presented by these four patients there are certain points of interest. Reese[11] believes that the exophytum type of tumor probably arises from the rod and cone layer of the retina, whereas the endophytum type is derived from the bipolar layer. It is interesting to note that in these four patients, who are closely related, both types of tumor occurred.

Reese[12] also has pointed out that most

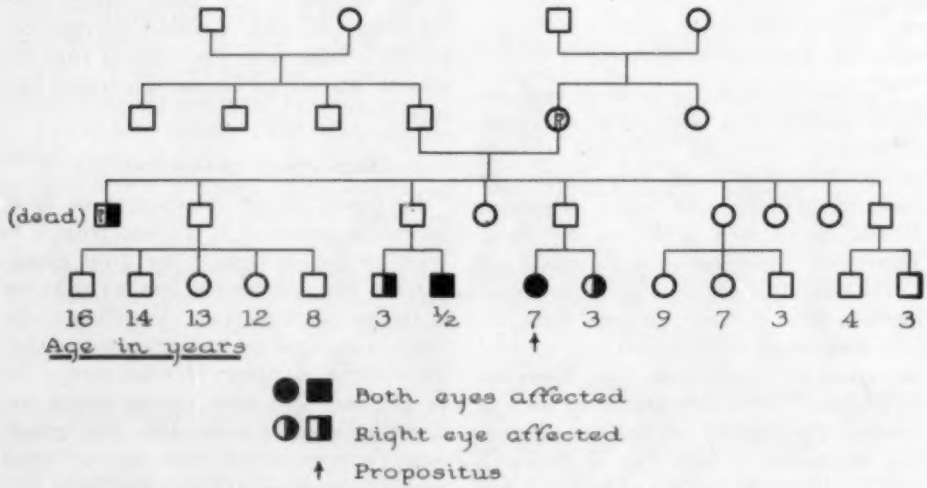

Fig. 3 (Nicholls). Hereditary pattern for the transmission of the retinoblastoma.

frequently a mixed type of cell growth is seen. Both undifferentiated retinoblastoma cells and more highly differentiated columnar type of neuroepithelioma cells are found. In certain cases one type of cell or the other may predominate. It is his feeling that tumors composed of the neuroepitheliomatous type of cell, being more highly differentiated grow more slowly, and therefore are less malignant.

In a more recent study, however, Herm and Heath[13] place a rather different construction on the relationship of malignancy to cell type. They feel that the longer the tumors are present, the more undifferentiated they become. In their study of a large series of tumors they found a greater percentage of cells of the undifferentiated type in the tumors having the longest history of existence. Also they found the mortality rate higher in this group. They felt the fact that the mortality rate was higher in the tumors consisting of undifferentiated cells was due to the tumor having been present longer, and not because it was more malignant.

The pathologic findings in the present four patients are interesting when interpreted in the light of these two points of view. It is safe to assume that Patient 2 had had her tumor for a shorter period than Patient 1, and yet her tumor contained fewer highly differentiated cells. Also Patient 3, it is safe to assume, had his tumors for a longer period than Patient 4 and his tumors had more highly differentiated cells. Further, the tumor in his left eye antedated apparently that in his right eye, and the former was more differentiated than the latter. Thus, the microscopic picture in the present series would seem to contradict the theory of Herm and Heath. Here the younger the tumor, the more undifferentiated it was.

A random point of interest, and perhaps of some significance, is that when one eye was affected in this family it always was the right. It is likely, however, that this is a matter of chance. Especially is this so in view of the bilaterality present in two cases.

With the presentation of this report, another family depicting the hereditary tendency of retinoblastoma is added to a growing list. This feature deserves to be emphasized again, as it is one which is often underestimated. Indeed, I was guilty of this failing when I had the first patient under treatment. After removing the second eye in this child, the mother came to me some months later saying she was pregnant and asking if there was much chance of this second child being similarly affected. I said, "I did not think so." In this opinion I was well supported by authority.

Reese[7] after an analysis of 378 sporadic cases, some reported by himself and some by others, states, "the likelihood that a second sibling will be affected is less than four percent and probably nearer one percent."

Manchester[8] is in essential agreement with this. It should be emphasized here, that the story is quite different among children of those who have survived retinoblastoma. Reese[7] made this point when he reported that in a group of six survivors who had a total of 10 children, nine of the latter had bilateral retinoblastoma.

More recently, Herm and Heath[13] have reported a series of eight survivors, having 16 children. Three of the latter developed bilateral retinoblastoma. On combining these two groups, there are 26 children of survivors, 12 of whom have had bilateral retinoblastoma. This establishes beyond any doubt the dominant character of the gene. This fact also is amply corroborated by the studies of Griffith and Sorsby,[4] Falls,[6] and by Sorsby.[10]

The present report illustrates the fact that the tumor may be transmitted as an irregular dominant. This latter mode of transmission has been demonstrated by others. Falls[14] points out that it can be estimated, from a study of the reported families, that retinoblastoma exhibits a 70-percent penetrance; that is, 70 percent of those who have the gene for this condition will actually have the disease. A realization of the significance of this point should make one more conserva-

tive when predicting the occurrence of retinoblastoma among relatives. The present family is a case in point.

The failure of the present family to express full penetrance may be due to a number of factors. Perhaps here in time it will be more fully observed; there still are some very young members in the family. It is possible that the affected gene may manifest itself in a number of ways, some of which at present we are not able to recognize. Also it could be that it is necessary for some factor to be present in the environment for the disease to manifest itself—and there are other possibilities.

The interest of the present family, then, is that retinoblastoma may have an hereditary transmission even when it makes a sporadic appearance. It has not been possible to trace this family beyond the maternal and paternal great grandparents and through collateral lines. Probably, however, this is not important. Aside from the four children reported in detail here, the deceased infant uncle, and possibly the grandmother, none have been affected. Also, no one has been affected in the families of either mother of these four children.

A study of this family suggests that the sporadic case may represent a somatic mutation. If this be so, the affected gene in this family must have made its first appearance at least two generations previous to the children, that is in their grandmother or grandfather. Thus, it is unfortunate, indeed, that more factual data regarding the loss of the grandmother's eye cannot be uncovered. Should her right eye have been enucleated for retinoblastoma, and not because of an injury, it would be significant. The mutation, then, would have had to take place one generation earlier.

Summary

1. The case histories of four members in the same family affected with retinoblastoma have been presented.

2. The family connections have been traced in detail.

3. The gene was transmitted as an irregular dominant.

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The mothers of the four patients reported in this study have been traced. The mother of the first family is an only child. Her father had two brothers and her mother had five brothers and one sister. These members had a total of five children. None was affected.

The mother of the second family has three brothers and four sisters having a total of 14 children. There are four paternal aunts and four paternal uncles, six maternal aunts and two maternal uncles. None of these was affected and, as far as is known, their descendants are free.

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A SIMPLIFIED ENTROPION OPERATION*

USE OF A PERMANENTLY BURIED HORIZONTAL SUTURE TO TIGHTEN THE ORBICULARIS

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In senile or spastic entropion, the lashes and skin of the eyelids rub against the cornea. This ocular irritation incites further lid spasm which aggravates the entropion. The resulting vicious cycle demands intervention. Use of adhesive tape is usually ineffective, as the adhesive is easily displaced by lid spasm and discharge. Operative intervention must be directed against the causes of entropion.

CAUSES OF ENTROPION

The three causes of entropion of the lower lid are illustrated in Figure 1.

First, cicatricial entropion may be caused by scarring of the tarsus, subconjunctival scar tissue, or symblepharon.

Second, a laxity of skin and tissue overlying the tarsal plate will allow the lower border of the tarsus to evert easily. As a result, the upper border of the relatively stiff tarsal plate will invert easily. In addition, the loose skin of the lid does not exert downward traction to prevent rolling in of the lid border. This is most frequently the case in older people with redundant skin and loose subcutaneous tissue of the lower lid. Kirby[1] has emphasized that flaccidity and elongation of all of the fibrous and elastic elements of the lower lid occur with age. Such changes in the tarsus itself are of importance. In senility, recession of the globe from loss of orbital fat also tends to permit entropion. These factors explain the age incidence of "senile spastic entropion."

The third major cause of entropion is spasm of the orbicularis muscle along the lid margin. This will invert the lid margin. Spasm of the orbicularis is likely to occur reflexly when the eye is irritated from any cause. This explains the frequency of entropion after cataract extraction, inflammation, and other irritative states. This role of orbicularis spasm is indicated in the term spastic entropion.

OPERATIONS FOR SENILE SPASTIC ENTROPION

The various operative procedures which combat the forces producing senile or spastic entropion are listed in Table 1. Spasm of the marginal orbicularis can be eliminated by direct excision[2-10] or cutting[11] of the marginal obicularis fibers, external canthotomy,[12-18] or by alcohol injection.[19-26] Most of the methods which depend on direct excision of marginal orbicularis also employ excision of skin and subcutaneous tissue[6-10] to tighten the pretarsal tissues. Canthotomy cuts the origin of the marginal orbicularis fibers. Alcohol injection into the lid[19-23] and the more temporary expedient of procaine or Xylocaine injections can be used to paralyze orbicularis function. Injections of alcohol into the peripheral branches of the facial nerve,[24-26] as in the region of the parotid plexus, produce a similar but more widespread effect. Section of the seventh nerve branches in this area has also been performed,[28,29] but this procedure is not to be recommended for simple senile spastic entropion.

Another principle is to shorten and therefore tighten the tarsus. Beard's description of von Graefe's operation includes a tarsal resection as an auxiliary aid in severe cases.[7] The tarsus may be resected in the center

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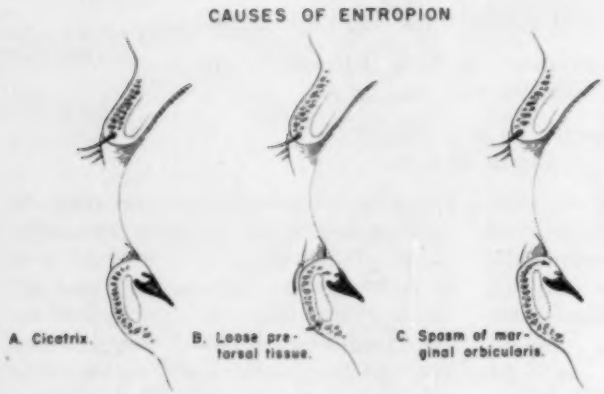

Fig. 1 (Schimek). *Causes of entropion:* (A) Cicatrix pulls lid border inward. (B) Loose pretarsal tissue permits inferior border of tarsus to tilt outward and thus upper border of tarsus inverts. Also, lax skin rolls upward so that lid border may roll in easily. (C) Spasm of marginal orbicularis inverts lid border.

of the lid[7, 31] or resected temporally and attached to the temporal fascia.[1, 32] These operations should be among the most effective for prevention of any possible recurrence of entropion in future years. Tarsal tissue and temporal fascia should not undergo relaxation from degeneration of elastic and fibrous tissues as rapidly as skin, subcutaneous tissue, or even orbicularis muscle.

Operations which combat laxity of the skin, subcutaneous tissue, or orbicularis over the lower portion of the tarsus are more numerous. The oldest prototype of this principle dates back to Hippocrates[33] and the use of a vertical ligature through a horizontal fold of skin which was allowed to suppurate out. Bands of scar tissue from inflammation along the path of the ligature provided some permanent correction for the entropion. The temporary vertical sutures of Gaillard,[34] Arlt,[35] Snellen,[36] and Stellwag[37] used the same principle with more modern modifications. Temporary horizontal sutures were first used by Montgommery[40] in 1886 and later by Koster.[41] Recently, they have been advocated again by Rössler[42] and Hartleib.[43] All of these entropion sutures are temporary, tightening mainly skin and subcutaneous tissue, usually tied over cotton pegs, partly buried and partly exposed, and dependent for permanent effect on variable scarring which may occur along the suture tract. This is in contrast with the permanent, completely buried suture tightening the orbicularis to be described in this report.

A Michel metal clip has been used by MacDonald[44] to tense temporarily the tissues of the lower lid to correct entropion. The various skin excision methods also produce either downward traction[6, 8, 45, 46] or lateral traction[7, 9, 10, 47–51] or both. The original skin excision method of Celsus produced downward traction, and was modified by Hotz.[6] Other skin excision methods by Imre,[51] Duverger,[9] and Blaskovics[10] produced lateral traction as well as downward traction. Buried skin flaps may be used for downward traction.[52] Scar tissue contraction over the tarsus is most commonly produced by the Ziegler cautery method.[54–57] In the past, chemicals, fire,[53] and pressure necrosis from crude instruments[58, 59] have been employed to produce contracture and scar formation of the skin and subcutaneous tissues of the lower lid to correct entropion. Tightening of the orbicularis over the lower portion of the tarsus has been a most satisfactory method for correcting entropion for many years.[60–63]

Recently, a horizontal incision through the entire lid thickness (cutting the tarsus) has been recommended for senile spastic entropion.[64] A horizontal incision through

TABLE 1

SURGICAL METHODS FOR SENILE SPASTIC ENTROPION OF THE LOWER LID

I. PREVENTION OF MARGINAL ORBICULARIS SPASM
- A. Excision of orbicularis (Beard,[2] 1914; Vialeix,[3] 1929; Busacca,[4] 1936; Kettesy,[5] 1948). (Combined with skin excision: Celsus,[6] 1st Century A.D.; von Graefe,[7] 1864; Panas,[8] 1873; Duverger,[9]; Blaskovics,[10] 1922)
- B. Vertical incision of marginal orbicularis fibers (Löwenstein,[11] 1917)
- C. External canthotomy (Pagenstecher,[12] 1862; Agnew,[13] 1875; Stellwag,[14] 1886; Weekers,[15] 1932; Poulard,[16] 1935; Pokhisov,[17] 1935; Vogt,[18] 1935)
- D. Alcohol injection into lid (Fumagalli,[19] 1909; Elschnig,[20] 1922; Dupuy-Dutemps,[21] 1926; Weekers,[15] 1928; Terson,[22] 1929; Hughes,[23] 1931)
- E. Seventh nerve block
  1. Alcohol injection (Schloesser,[24] 1903; Safar,[25] 1930; Benedict,[26] 1941)
  2. Electro-coagulation (Safar and Spitzmuller,[27] 1932)
  3. Neurectomy (Gurdjian and Williams,[28] 1928). With facio-hypoglossal anastomosis—Harris and Wright,[29] (1932)
- F. Orbicularis transplant behind tarsus (Sanchez-Bulnes,[30] 1944)

II. TIGHTENING OF LOWER PORTION OF TARSUS
- A. Tarsal resection (von Graefe,[7] 1864; Butler,[31] 1948)
- B. Tarsus resected and attached to temporal fascia (Kirby,[1] 1953; Guyton,[32] 1953)

III. TIGHTENING OF SKIN AND SUBCUTANEOUS TISSUE OVER LOWER PORTION OF TARSUS
- A. Temporary sutures, partially exposed
  1. Vertical sutures (Hippocrates,[33] 5th Century, B.C.; Gaillard,[34] 1844; Arlt,[35] 1856; Snellen,[36] 1862; Stellwag,[37] de Grandmont,[38] 1889) (Skin-sutured to tarso-orbital fascia—Trantas,[39] 1913)
  2. Horizontal sutures (Montgomery,[40] 1886; Koster,[41] 1916; Rössler,[42] 1949; Hartleib,[43] 1950)
- B. Michel's metal skin clips (MacDonald,[44] 1945)
- C. Skin excision exerting:
  1. Downward traction (Celsus,[6] 1st Century A.D.; Panas,[8] 1873; Jaesche,[45] 1882). (Strip of skin buried—Piccaluga,[46] 1911)
  2. Lateral traction (du Villards,[47] 1838; Janson,[48] 1847; von Graefe,[7] 1864; Goldzieher,[49] 1908; Koster,[50] 1916; Duverger[9]; Imre,[51] 1938; Blaskovics,[10] 1922)
- D. Buried skin flaps exerting downward traction (Lebensohn,[52] 1953)
- E. Scarring produced by:
  1. Cautery (Susruta,[53] ancient Hindu; Peschel,[54] 1898; Agababow,[55] 1905; Terrien,[56] 1906; Ziegler,[57] 1909)
  2. Pressure necrosis (Paul of Aegina,[58] 7th Century, A.D.; Chen Hou-Hsi,[59] 1821)

IV. TIGHTENING OF ORBICULARIS OVER LOWER PORTION OF TARSUS
- A. Orbicularis operation (Wheeler,[60] 1938; Birch-Hirschfeld,[61] 1938; Meek,[62] 1940; Hughes,[63] 1951)
- B. Permanent buried horizontal suture (present report)

V. HORIZONTAL LID INCISION THROUGH TARSUS (Wies,[64] 1954)

conjunctiva and tarsus with a partial tarsectomy has been used by Kuhnt,[65] but mainly for cicatricial entropion.

Recurrence of entropion often results after use of temporary sutures, cautery, skin excision methods, and alcohol injections. Excess scar tissue may occur from cautery, and from excision of skin and orbicularis. Excess scarring complicates any later surgery which may be necessary and is cosmetically undesirable. It also may pull the lid downward out of proper position.

The Wheeler orbicularis operation for entropion gives satisfactory results but has the disadvantage of being a greater operative procedure than some of the other methods. Both the Wheeler operation and the new operation described in this report tighten a strip of orbicularis muscle which holds the lower portion of the tarsus in position. This prevents inversion of the upper border of the tarsal plate, as shown in Figure 2.

A NEW SIMPLIFIED ENTROPION OPERATION

Tightening of the orbicularis fibers over the lower portion of the inferior tarsus may be easily accomplished by a horizontal permanently buried suture. By contrast with the Wheeler operation, there is a minimum of dissection and bleeding with this technique. In previously operated cases with

Fig. 2 (Schimek). *Effect of horizontal suture tightening orbicularis:* The tightened orbicularis muscle holds in the lower portion of the tarsal plate preventing inversion of the upper border of the tarsus.

extensive scarring, this minimum of dissection and bleeding is a great advantage. It can be done easily as an office procedure.

Temporary skin sutures tied over pegs which are removed after about a week (table 1) are to be contrasted with this permanently buried suture tightening the orbicularis. The former are temporary and exposed while the latter is permanent and buried. The former tighten skin and subcutaneous tissue while the latter tightens orbicularis muscle. For a permanent effect, the former must depend on variable scarring which may occur along the suture tracts from infection of the exposed sutures. The latter exerts a permanent tightening effect on the orbicularis from the permanently buried suture and the slight amount of scar tissue reaction surrounding it. No references can be found in the literature which describe a permanently buried horizontal suture tightening the orbicularis.

Technique

A local anesthetic is injected along the lower lid and temporal to the outer canthus. A small incision is made about three mm. below the lash margin and three to four mm. nasal to the center of the lower lid with either a knife or scissors (fig. 3-A). The lid incision is most easily made by picking up a vertical fold of skin with forceps and making a horizontal snip through the skin with scissors. With the same technique, another skin incision is made two cm. temporal and 0.5 cm. above the outer canthus (fig. 3-A).

Although the skin incisions may be either vertical or horizontal, horizontal incisions are preferable. With horizontal incisions, the wound edges tend to remain in good apposition and blend into the skin folds. The skin about the incisions is partly undermined by blunt dissection with scissors.

By introducing a skin hook into the lid incision, a good-sized bundle of orbicularis fibers can be lifted out of the wound. A 4-0 black silk suture is passed through the bundle of orbicularis fibers and tied (fig. 3-B). Both arms of the suture are threaded on a long intestinal needle. The needle is inserted into the lid incision, passed subcutaneously across the lid, and out of the temporal incision. Both arms of the suture are pulled along the path of the needle and out of the temporal incision (fig. 3-C). Next, one arm of the suture is threaded on a curved needle and passed through the orbicularis and temporal fascia in the temporal incision (fig. 3-D). This is facilitated by elevating orbicularis and temporal fascia by either a skin hook or toothed forceps.

Tension on the suture will evert the lid margin (fig. 3-E). The suture is tied with sufficient tension to overcorrect the entropion and produce an ectropion of moderate degree. The suture is then cut and the ends allowed to retract into the wound (fig. 3-E).

The temporal incision and lid incision are each closed with interrupted 6-0 black silk sutures (fig. 3-F). With horizontal inci-

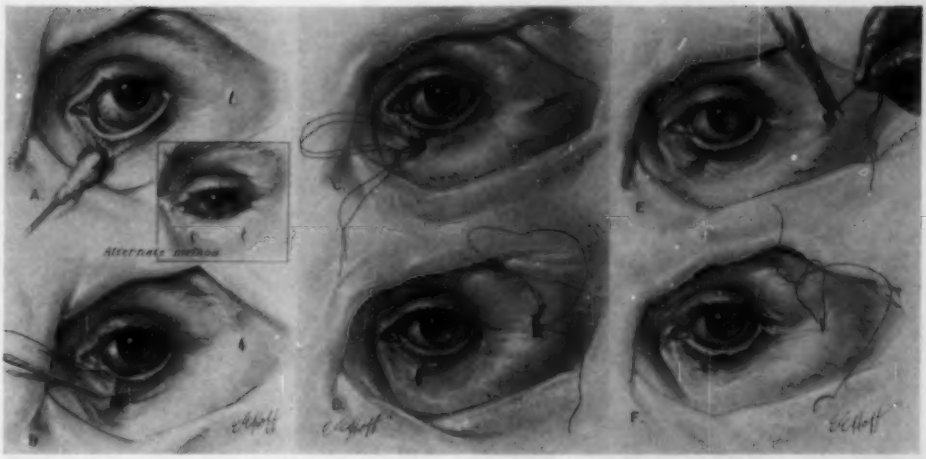

Fig. 3 (Schimek). *Technique of horizontal buried suture for entropion.*

(A) Incisions are made with stitch scissors three mm. below the lid border and temporal and slightly above the outer canthus (incisions preferably should be horizontal). Insert: This shows a modified but less satisfactory position for the skin incisions.

(B) A 4-0 black silk suture is tied about a bundle of orbicularis in the lid incision.

(C) Both arms of the suture are threaded on a long intestinal needle and passed subcutaneously over to and out of the temporal incision.

(D) One arm of the suture is threaded on a curved needle and passed through orbicularis and fascia in the temporal incision.

(E) The suture is tightly tied (so that the lid border is everted), cut, and allowed to remain buried.

(F) The skin incisions are closed with interrupted sutures.

sions, often no suture is needed for the small nasal lid incision, and only one suture is required for the temporal incision. The skin sutures are removed four to five days after operation.

A temporary ectropion must be produced to guard against any recurrence of the entropion, as in the Wheeler operation. This temporary overcorrection assures a permanent cure. The more overcorrection desired, the tighter the buried suture must be tied, and the more nasal the lid incision must be placed, and the more lateral the temporal incision must be placed. All these factors increase orbicularis tightening against the lower portion of the tarsus. It is important to make the initial lid incision about three to four mm. below the lash line. If the su-

TABLE 2*

RESULTS IN 23 CASES OF ENTROPION TREATED WITH A HORIZONTAL PERMANENTLY BURIED SUTURE TIGHTENING ORBICULARIS OVER THE LOWER PORTION OF THE TARSUS

Suture From Lid To Temporal Area	No. of Operations	Average Follow-up	No. of Infections	No. of Recurrences
4-0 silk (senile spastic entropion)	19	22 mo.	2	2
4-0 silk (cicatricial entropion requiring other plastic surgery)	2	20 mo.	0	0
3-0 chromic catgut (senile spastic entropion)	2	17 mo.	0	0

* The first group of cases were done for simple senile spastic entropion. The second group of cases were performed on cicatricial entropion and required additional plastic surgery done at the same time as the suture placement. The third group of cases were very mild cases of entropion corrected by a buried, chromic catgut suture.

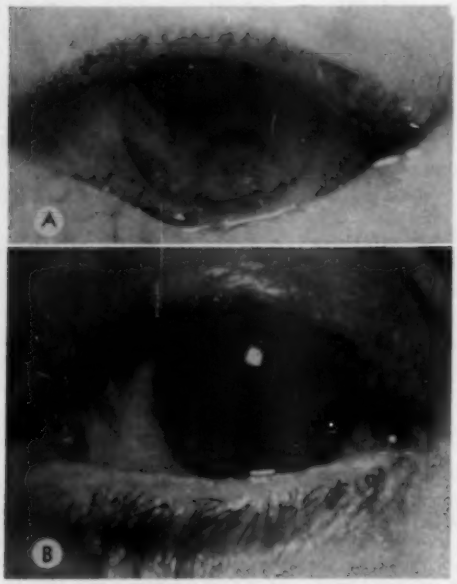

Fig. 4 (Schimek). Senile spastic entropion following cataract extraction in an 85-year-old white woman. (A) Before operation. (B) Two weeks after use of a permanently buried horizontal suture to tighten the orbicularis.

ture is placed more than five mm. from the lid margin, it may not overlie the tarsus, and thus be less effective.

Results

Table 2 summarizes the results in 23 cases of entropion treated with a buried suture from the lid to the temporal area. Of the 21 cases in which a 4-0 black silk suture was used, 19 cases were simple senile spastic entropion and two were entropions with cicatricial changes. In the two cases with cicatricial changes, other plastic surgery to remove scarring was performed simultaneously. All 23 of these cases were initially successful. On follow-up there were two recurrences. One entropion recurred after bilateral cataract extraction and was accompanied by entropion of the other previously normal lower lid. The recurrence was recorrected by placing an additional horizontal buried suture from the lid to the temporal area. There was no difficulty in reoperating on the same lid, and the entropion has since remained nicely corrected. The other recurrence appeared nine months after removal of an infected suture.

Two cases developed a small stitch abscess which promptly cleared when the buried suture was removed. In these two cases, the sutures were easily withdrawn since the ends of the sutures became extruded. In one of these cases the entropion remained permanently corrected, apparently due to scarring along the suture tract. In the other case, the entropion remained corrected for nine months after the buried suture was re-

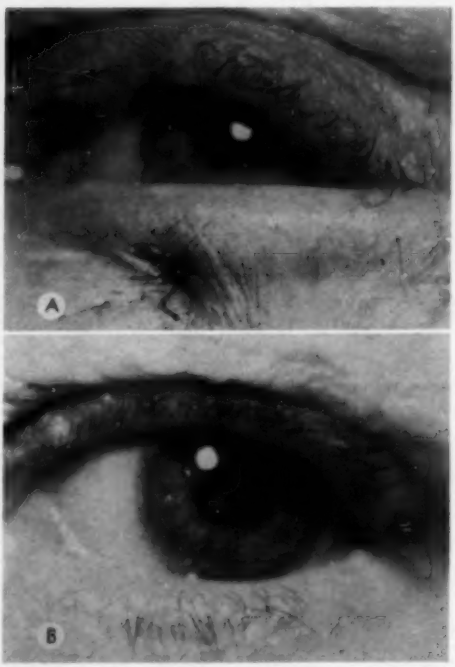

Fig. 5 (Schimek). Recurring senile spastic entropion in a 68-year-old white woman. Ziegler cautery (1948), canthotomy (1949), and Wheeler operation (1950) were only temporarily successful and were all followed by recurrence of entropion. (A) Immediate postoperative picture following use of a permanently buried horizontal suture to tighten the orbicularis, showing temporary ectropion to insure permanent correction. (B) Lid in normal position two weeks after operation.

moved, and then recurred in very mild form. There were no other postoperative complications in the series.

Some of these successfully operated cases had a history of other entropion procedures. For example, one case had recurred after Ziegler cautery, had recurred again after external canthotomy, and had recurred again after a Wheeler operation (fig. 5). Following placement of a horizontal permanently buried suture, there has been no recurrence during a two-year follow-up period. Placement of this buried suture was just as easy as in a case without the scarring of previous cautery and surgery. Because so little dissection is required, this method has a real advantage for those lids with scar reaction from previous Ziegler cautery or lid surgery.

In three operations, a buried chromic catgut suture was used for correction of simple senile spastic entropion with no recurrence during the follow-up period. The chromic catgut sutures were used only in mild entropion caused by temporary irritation with the aim of correcting the acute entropion. Recurrence of the entropion is prevented by scarring along the tract of the absorbed chromic sutures, and the removal of any source of ocular irritation such as inflammation and the original entropion itself.

A different technique has been used to insert a buried 4-0 black silk suture in two additional cases. The operative technique was modified so that two skin incisions were made in the nasal and temporal portions of the lid about three to four mm. below the lid border (fig. 3-A, insert). A 4-0 black silk suture was tied about a bundle of orbicularis beneath one skin incision. The two arms of the suture were then passed subcutaneously to and out of the other incision. One arm of the suture was passed through a bundle of orbicularis beneath the second incision, and the suture tied to exert sufficient tension to evert the lid. The skin incisions were closed with the horizontal suture remaining buried. With this modification it is more difficult to obtain sufficient suture tension to achieve the proper correction. The entropion was not sufficiently overcorrected in the two cases in which this modified technique was used, resulting in recurrence one year later.

Summary

A simple method for correction of entropion has been presented. This method tightens the orbicularis muscle over the lower portion of the tarsus by a permanent buried horizontal suture. Because of the minimum dissection required, this technique is particularly valuable for recurrent senile spastic entropion with scarring from previous cautery or surgery.

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GLAUCOMA RECORDS IN PRACTICE*

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New York

Experience has demonstrated that precise methods of recording the findings during periodic examinations of patients[1] with glaucoma are mandatory. Glaucoma records are otherwise usually incomplete and the patient's eye condition may be endangered, unnecessarily. Advancing knowledge of glaucoma necessitates frequent changes in glaucoma records especially in parts concerning physical and ocular findings. In the following paragraphs our current method of recording history, physical, and ocular findings at each visit is described. It has facilitated our work and often has clarified diagnosis; therefore, it is hoped that this outline of procedure may be useful to others.

As soon as the diagnosis of glaucoma is made, a red star is drawn on the upper right hand corner of the patient's record folder and on the record. This indicates that the diagnosis of glaucoma had been made and is more practical than a pasted-on red star which often becomes unglued. The red star also signifies that the following pamphlet on glaucoma had been given to the patient. The term glaucoma is avoided because patients often fear glaucoma and when pressure within the eyeball is spoken of, they relate this to increased blood pressure which they usually believe they understand and which disturbs them less.

INFORMATION CONCERNING YOUR EYE CONDITION
(Increased pressure within the eyeball)

As a result of our examination, it has been established that the pressure in your eyes is above the level which is considered normal, and if this is allowed to continue unchecked, gradual impairment of your vision could result.

* From the Department of Ophthalmology, New York University Post-Graduate Medical School. Aided by a grant from The Ophthalmological Foundation, Inc., and the Department of Research of the New York Associaiton for the Blind.

The condition of increased pressure in the eyes occurs in two main forms, a chronic and an acute form. In the chronic type, the symptoms are usually mild and insidious, and quite often go unnoticed by the patient. There are, however, a number of warning signs, which should be kept in mind. These are as follows: (1) seeing rainbowlike colored rings or haloes around lights, (2) brief attacks of blurred vision, (3) loss of or decrease in side-vision, especially to the nasal side, (4) unusual delay in adjustment of your eyes in dark surroundings, (5) a sense of fullness and mild aching in and about the eyes, (6) the need for frequent change of glasses or for unduly strong reading lenses for your age. Only one eye may be affected, but usually both eyes become involved. The danger of this chronic form of increased pressure lies in the mildness of the symptoms, so that too often there is slow, progressive damage to the retina or seeing coat of the eye without the patient being aware of it. For that reason, careful periodic eye examinations should be made which should include the determinaiton of the eye pressure.

The acute form of the disorder begins with sudden intense pain, blurring of vision, inflammation of the eyes, and is often associated with an upset stomach. Because of the disturbance of vision and severe discomfort, there is greater likelihood that prompt medical advice will be sought for this type of increased pressure, and that the physician's instructions will be more faithfully carried out.

When increased pressure in the eyes has been diagnosed, continuous and conscientious care is required to prevent loss of vision. Since central vision, which is used in reading, becomes involved only in the more advanced stages of the disease, you may not be aware of the gradual visual impairment. Consequently it is imperative that you be examined regularly by an eye physician.

In order to determine whether the condition is under control, it is important that visual field studies (to determine the condition of side-vision), measurement of the eye pressure with an instrument (tonometer), and examination of your vision and glasses be done at regular intervals. *If drops are prescribed, it is a matter of utmost importance that you instill them regularly, according to your physician's instructions.* Even an occasional omission is unwise. When traveling you should be particularly careful to carry a supply of medication with you.

In addition to the care of your eyes, there are a number of suggestions concerning your general health which should be followed. A thorough general physical examination is desirable. Your ophthalmologist (eye physician and surgeon) and your general physician should co-operate and should understand your physical and mental condition completely. Any focus of infection, such as diseased tonsils, teeth, sinuses, or chronic infections of the intestinal tract, should be eliminated if possible, or at least resistance raised against the infections by accepted means of treatment. Allergic conditions should be treated. Rest and relexation are important, and irritating duties and situations should be avoided, for worry and mental strain tend to raise the pressure within the eyeball. Excessive amounts of tea, coffee, tobacco, and alcohol should be avoided. If you are being treated by a physician for any other illness, he should be advised of your condition so that he will not prescribe drugs that may have a tendency to raise eye pressure. One of the most important drugs to avoid is belladonna in any form unless you are advised it will not be harmful in your case.

If treatment is instituted early and carried out faithfully, the pressure can usually be controlled and loss of sight prevented. Continuous treatment and observation at regular intervals are for your own protection. Treatment should not be discontinued unless you are advised to do so by an ophthalmologist (eye physician and surgeon) after careful study of your eyes.

In some cases, surgery is necessary in order to prevent loss of vision and some of the foremost authorities believe that surgery offers the best chances of preventing permanent impairment of eye function. In this eye condition, more than in any other, you must have complete confidence in your physicians and follow their instructions faithfully.

Please detach and return to this office

I have read this statement carefully and understand that the pressure in my eyeball is increased. I realize fully that I must continue the use of eyedrops and treatment regularly and faithfully as prescribed unless discontinued by an ophthalmologist (eye physician).

Patient's signature ———————————

Address:

In the past, several glaucoma patients who discontinued treatment and lost vision unnecessarily have complained that they were not told of their condition or of a need for continued supervision and treatment. Because of this, all glaucoma patients are requested to read the pamphlet and return the tear tab to the office with their signature affixed to the statement to make certain that they have read the brochure and understood the situation.

At subsequent examinations, all patients' records which are red starred, are stamped with a special glaucoma rubber stamp (fig. 1) each time the patient enters the office.

The data desired include the time the examination was made and tension taken, vision each eye, with or without correction, pinhole vision, and near vision. The recent

sc R. ..... PH
L. ..... PH No Imp.

DATE 11/15/55 HOUR 10 AM PM TON. Schiötz V. cc R. 20/20 PH 20/20 L. 20/30 PH 20/30 PPA R. 180/400 L. 220/400

	WT	5.5	7.5	10	Pupil	O.T.	GMS	MIN
R.		22		24	2mm.	18/10	50	2
L.		30		28	3mm.	25/10	50	2

Anesth. Drug Dorsocaine 0.4%
Miotic Drug USED LAST
P= Pilocarpin R. P 2% T.I.D AM
E= Eserine % 10 PM
C= Carcholin L. P 2% B.I.D AM
D= DFP C. 15% H.S. 10 PM

Recent History

Severe emotional stress because of coronary attack of husband (11/13/55)

Recent Physical Findings

Chronic ethmoiditis, left (Dr. Craig-11/10/55)

Massage Last 11/15/55-9AM
Field Last 1/10/55
Refraction Last 1/10/55
Barometer - 30
Humidity - 94%
Weather - raining

Systemic Medication

Last Dose
Dramop-daily-250 mg 7AM
Phenobarbitol 1/4 gr. 11/14/55
Other Sedatives
Seconal gr 1½ - 10 P.M. Today at bedtime

Fig. 1 (Berens, Carter, and Breakey). Rubber stamp for glaucoma.

past history of the patient, that is, whether the patient had had a bad night because of gastro-intestinal upset, or one of his relatives had died recently, or there had been a difficult marital situation to face, is included in the report.

Under recent physical findings the following statement may be recorded: the patient had had two teeth removed because of abscesses, or had suffered a recent coronary thrombosis. If a history of sinusitis is present, which sinuses are affected and which side of the nose is most troublesome should be noted.[2]

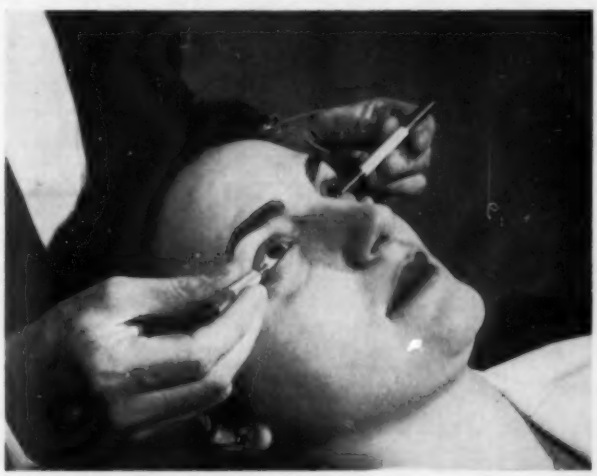

Fig. 2 (Berens, Carter, and Breakey). The outflow test is performed by applying two special bulbar compressors or two Bailliart ophthalmodynamometers simultaneously to both eyes. The eyelids may also be closed during the test.

One column is for tonometric findings. The tonometer and weight used are noted in the proper section. The needle of the tonometer should fluctuate with the vascular pressure and the lowest point of fluctuation (highest pressure) should be noted as the tension. Then the outflow test is employed; the duration and amount of pressure applied to the eyeball and resulting tensions are noted. For example, the outflow test was performed with 50-gm. pressure applied for two minutes. For this purpose we use two Bailliart ophthalmodynamometers or two special bulbar outflow pressure applicators, applied simultaneously to both eyes just anterior to the insertion of the lateral recti[3] (fig. 2). The tension is taken before and after the pressure is applied. We find that this is a test which one can easily do in practice within the time that one can ordinarily devote to this part of the examination. The record of medication is kept by marking the abbreviation for the drug used, for example, P for pilocarpine, and noting in the proper place on the record the exact hour the drug was used last. In the same square notation is made concerning the use of any nontopical antiglaucoma drug, for example, Diamox, and when the last dose was taken.

At the same time the tonometric record sheet with a red tab on its lower right hand corner is filled in by the nurse (fig. 3). She records the tension in each eye, noting the drug and tonometer used. If a patient has had recent glaucoma surgery, or has had any serious physical or mental disturbance, these are noted on this tonometer sheet.

Examination of this record facilitates the study of the changes in the tension over a long period of time in relation to the use of medical treatment, mental and physical disturbances, and operations. We consider these data important in determining whether or not one should perform surgery. Space is also provided for the dates when the patient last massaged the eye, when the field was

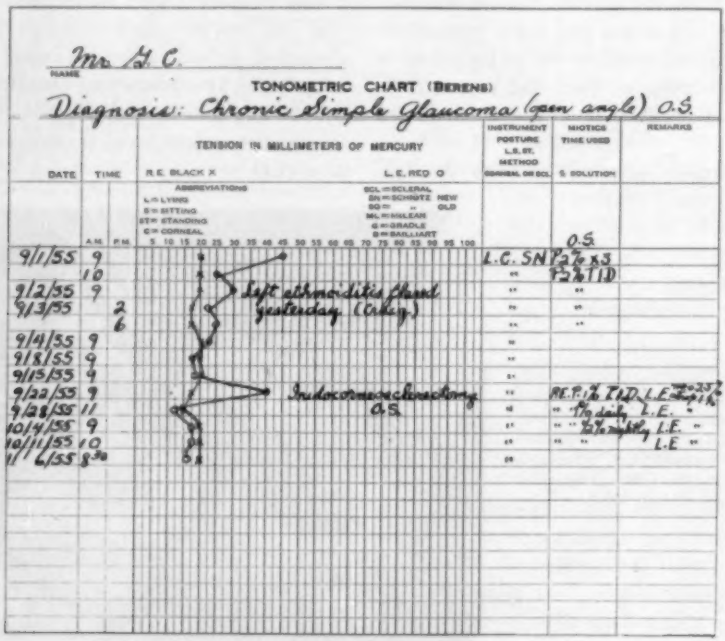

Fig. 3 (Berens, Carter, and Breakey). Tonometric chart.

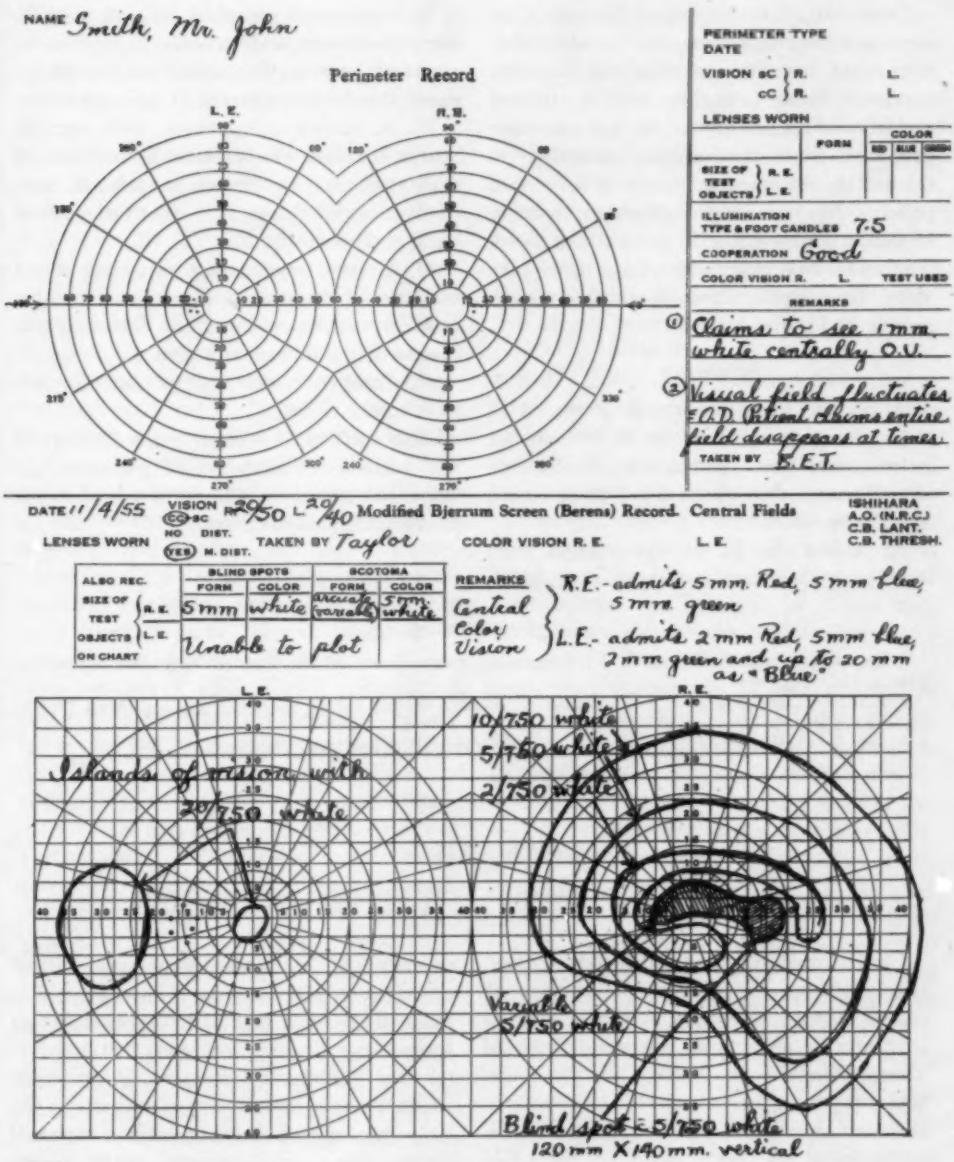

Fig. 4 (Berens, Carter, and Breakey). Visual field chart. Typical visual field changes in a patient with advanced glaucoma, O.S., and early glaucoma, O.D.

last taken, and when the last refraction was performed.

These data are important because they serve not only as a reminder to take fields frequently but also whether the patient's maximum visual acuity has been ascertained and what effect massage of the eye may have produced. Since atmospheric conditions influence the intraocular pressure in certain patients, the barometric pressure, relative humidity, and weather in general are noted. The visual field chart with a large space provided for tangent screen findings is represented in Figure 4.

Summary

A concise, clear but complete record of a glaucoma case is of benefit to both the patient and the ophthalmologist. Several suggestions for obtaining this type of record have been made.

A. A red star in the upper right hand corner of the chart to denote a glaucoma record and that the pamphlet under (B) has been given to the patient.

B. A glaucoma pamphlet for education of the patient with a detachable section to be returned bearing the patient's signature as proof that he is cognizant of its content.

C. A rubber-stamp form with specific spaces for data which should be recorded at each visit covering tension in each eye, time of day, use of drugs, and record of outflow tests, if performed.

D. A space to encourage recording recent history and physical findings.

E. A tonometer chart for following the course of the disease at a glance.

F. Field chart with a large space for tangent screen findings.

This method of recording the findings of the periodic examination of glaucoma patients has proven invaluable to us and its use is recommended to others.

708 Park Avenue (21).

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EYE ARMOR*

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Certain anatomic and physiologic peculiarities of the eye make the prevention of ocular injury much more profitable than its treatment by any known medical or surgical means. The delicate balance of the intraocular pressure mechanism, the loose attachments of the retina, and the required degree of clarity of the optical media are but a few of those unusual features which tend to limit good therapeutic results. The size and delicacy of the ocular tissues make their examination and handling a special problem in itself and the common complications of serious eye disease are always at hand to threaten a successful outcome. What would be an insignificant injury elsewhere in the body may immediately, or after a series of disheartening developments, result in the total loss of vision in one or even both eyes.

World War II and the Korean conflict saw an ever-increasing use of the fragmentation type of explosive weapon with a cor-

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responding increase in wounds of the eye. Hundreds of soldiers were completely blinded by tiny particles of flying metal or secondary missiles of earth and sand thrown up by the explosion of grenades, mines, or mortar shells. Thousands more lost a single eye.

Available figures do not reflect the total loss because of the likelihood that many injured eyes counted as partially recovered will eventually fall victim to secondary glaucoma or other late complication—a well-known outcome in cases of this kind. The impossibility of restoring useful vision in the greatest proportion of the eye wounds seen during the war years convinced everyone concerned that by far the best treatment for eye injuries is their complete prevention.

This is an accepted fact in industry where it has been shown over and over again that a well-controlled eye-safety program is medically and economically sound. Protective devices are used routinely wherever the hazard of eye injury exists. Mechanics with their hammers and chisels, operators of power tools of all descriptions, and even office employees whose work brings them into hazardous areas are protected against flying particles by goggles incorporating impact-resistant lenses of plastic or hardened glass. Certain occupations or tasks entail special risks and special devices are utilized. The possibility of chemical or thermal burns necessitates the use of goggles with especially close fitting frames and the danger of injury by infrared or excess visible light requires tinting of lenses. So important and so widespread is the eye safety program in industry that Federal law governs the specifications of protective goggles as to thickness, impact resistance, and optical properties of the lenses, the sturdiness of the frames, their noninflammability, and other details of manufacture.

The feasibility of the use of eye armor in American combat troops has been considered for years but nothing worthwhile has been written. Until recently, any concept of a protective device for soldiers included its ability to withstand the impact of large-caliber, high-velocity missiles because these were among the hazards to which a soldier was exposed. Experience gained in the Korean war,* however, showed that the great proportion of eye wounds were not caused by large shell fragments or by rifle or machine gun bullets but instead, as has been said, were produced by small particles no larger than those bits of metal against which the industrial worker is so effectively protected. Indeed, the problem of eye protection in soldiers is now so similar to the problem of eye protection in industry that it is the intent of this paper to show that the majority of eye wounds can be prevented in warfare by protective devices no stronger or more complicated than the ordinary industrial safety goggle.

The eye wounds encountered during the Korean war could be divided into several categories according to the frequency of their occurrence. The type of injury seen most commonly was the perforating wound of one eye. The shell fragments responsible were from 0.5 mm. to 10 mm. or more in size (figs. 1A and 1B)† and had only enough force to perforate the eyeball or, if a double perforation were produced, the missiles remained in the orbit. Associated with this type of wound there often were other scattered penetrating wounds of the face, trunk, and extremities.

Usually, removal of intraocular foreign bodies, successful or not, was attempted in Korea or Japan and, usually, the affected eye was badly inflamed and had only poor light perception on arrival of the soldier in the United States some two or three weeks after the original injury.

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* The eye injuries upon which these conclusions are based were seen in soldiers hospitalized at Walter Reed Army Medical Center, Washington, D.C., between 1950 and 1954.

† The specimens shown in Figures 1A and 1B were extracted from wounded eyes in Korea by Capt. Shigeo Shinkawa of the 121st Evacuation Hospital.

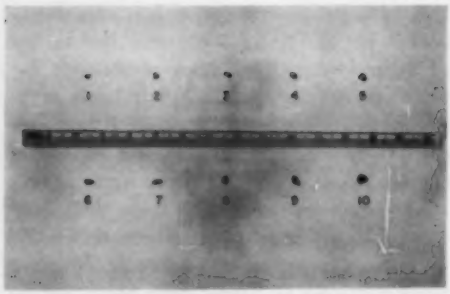

Fig. 1A (Fair). A collection of small shell fragments of the size that caused the majority of the eye wounds seen in World War II and the Korean conflict.

It was soon learned not to temporize with inflamed eyes that obviously would never see again. Those eyes that were blind and disorganized were removed immediately. These were in the majority and showed, in addition to the wound, one or more complications such as retained foreign body, hemorrhage in the vitreous, traumatic cataract, anterior chamber filled with vitreous and lens material, flat chamber, uveitis, anterior and posterior synechias, secondary glaucoma, and retinal detachment.

Occasionally an eye was found in which the inflammation subsided quickly. These eyes, even if blind, were saved for cosmetic reasons. Very rarely, in the case of a perforating wound, the lens and vitreous remained clear.

Even these eyes were doomed if a retained foreign body were nonmagnetic. A large percentage of the shell fragments encountered were nonferrous alloys and so were incapable of being attracted by the electromagnet. Figure 2 is a fundus photograph of a retained nonferrous metallic intraocular foreign body which could be visualized where it lay imbedded in the retina and choroid.

While the results in the above described class of eye wounds were poor, they were not as bad as those obtained in the second most common type of eye injury—that seen in soldiers who survived the blast of a mine or grenade or mortar shell. Multiple perforations of the globe by minute metallic particles or by grains of sand or powder were common in these cases along with "peppering" of the cornea and tattooing of the skin of the face and lids. Often, both eyes were involved.

Figures 3A and 3B show examples of this type of injury. Although the particles were very small in these cases, their effect on the eyes was disastrous. Imbedded foreign bodies with scarring of the cornea, cataract, and intraocular hemorrhage were the rule. Most of the cases of bilateral blindness were produced by this mechanism. Figure 3C illustrates the complete destruction of both eyeballs (and loss of both hands) in an accidental front line dynamite explosion.

A third and smaller group of eye wounds was that made up of injuries of the eye and

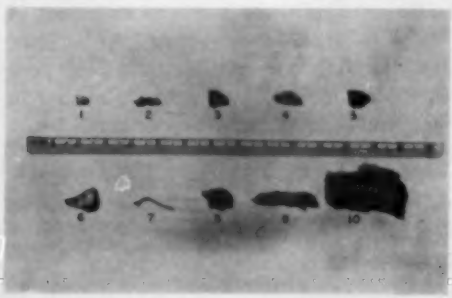

Fig. 1B (Fair). A group of larger missiles which, despite their size, had only enough force to penetrate the eye. The first particle is a bit of stone.

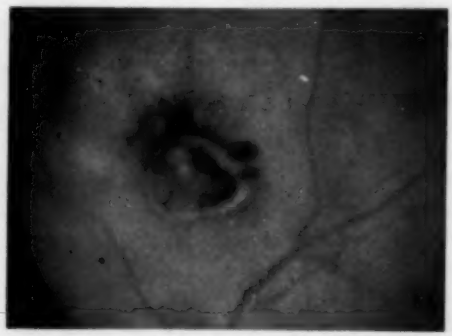

Fig. 2 (Fair). Fundus photograph of retained nonferrous metallic intraocular foreign body (shell fragment) imbedded in the coats of the eye.

orbit which accompanied head wounds. These were caused by larger shell fragments or by rifle or machine gun bullets, being characterized by loss of brain substance and defects in the skull and facial bones. An eyeball in the path of such a missile was often completely destroyed. Severance of the optic nerve in the orbit was a frequent finding along with defects in the lids, obstruction of the nasolacrimal duct, sinus infections, and osteomyelitis. A bad aspect of these injuries was the fact that the seriousness of the head wound overshadowed the eye situation so that often the eye injury went untreated for days. At one time, it was decided to provide neurosurgical teams in Korea with an ophthalmologist but this arrangement was not satisfactory for a number of reasons and was abandoned.

Mention should be made of a fourth or miscellaneous class of eye wounds consisting of abrasions and contusions of the globe produced by large but spent shell fragments and by the particle that failed to penetrate the sclera but skipped along its outer surface leaving choroidal breaks and retinal hemorrhage in its wake. Deep abrasions of the cornea left dense scars which interfered with vision while heavy blows on the eye caused dislocation of the lens and contrecoup rupture of the choroid. Large retinal hemorrhages were slow to resorb and left corresponding visual field defects.

These were the four general types of eye wounds seen during the Korean war. The first, second, and fourth groups could have been prevented almost completely by the use of the ordinary safety goggle. The missiles which produced these wounds had little force either because they were very small in size or were of low velocity or both. Only the vulnerability of the eye made them dangerous. Elsewhere in the body they could have caused only insignificant penetrating wounds of the skin and subcutaneous tissues. These facts were made obvious hundreds of times to those dealing with Korean casualties.

Fig. 3B (Fair). Multiple penetrating shell fragment wounds of both eyes with tattooing of the skin of the face and lids.

Only in the third group of less frequent cases in which eye injuries complicated wounds of the head would protection of the eyes be ineffective. In these cases, protection of the head and face is the problem to be solved. Most of the other eye injuries commonly seen in the Korean wounded could easily have been eliminated by the wearing of goggles in which the lenses and frames had no greater ballistic value than those used daily in many industrial concerns.

Fig. 3A (Fair). Multiple penetrating shell fragment wounds of the face and lids. The right eye is blind; the left, missing.

Fig. 3C (Fair). Complete destruction of both eyeballs in accidental front line dynamite explosion.

Fig. 4 (Fair). The spectacle type of protective goggle with tempered glass lenses and side shields.

It has been said here repeatedly that presently available models of safety goggles would adequately protect the eyes of the combat soldier. Of the several kinds in common use, the spectacle type with side shields should be the most suitable (figs. 4 and 5). Actually, it would be of no more inconvenience than the ordinary pair of spectacles which many soldiers must wear. Other models such as the eyecup type and cover-all goggles are usable in industry where the worker is not required to move around a great deal and has his work centered before him so that restriction of peripheral visual field is not objectionable.

The activity demanded of a soldier requires that any protective device be easy to maintain in position on the face and that peripheral vision be impaired as little as possible. These are some of the problems that have hindered the development of eye armor in the past. Many objections to its use have been automatically overcome by the recognition that heavyweight and cumbersome equipment is not required.

Formerly, it was useless to mention protection of the eyes in soldiers because of the newness of the idea. Now that body armor has proved to be effective and has become popular with the soldier, it is felt that eye armor is much more likely to be accepted by all concerned. Both the soldier and his commander are more armor minded. Impressing the individual with the necessity of the use of eye armor is the greatest difficulty foreseen. This has been the experience in industry where extensive education programs and penalties for failure to wear protective devices have been necessary. In the Armed Forces, if anywhere, compliance of the individual can be expected. Eye armor should be made familiar to the soldier in his basic training period and not thrust upon him as he moves into the combat zone. In this way, he will not be incapicitated in battle by the addition of strange equipment and will accept his eye armor as essential gear. Besides, military service is hazardous even in the training camps. Accidents to eyes are common during field exercises and demonstrations. There is more than enough danger wherever large or small weapons are being fired to warrant protection of the eyes. Many jobs considered hazardous in industry are no more dangerous to eyes than the daily routine of the infantry soldier or artilleryman.

Since the essential feature of any goggle is its lens, most of the problems connected with the use of eye armor are brought out

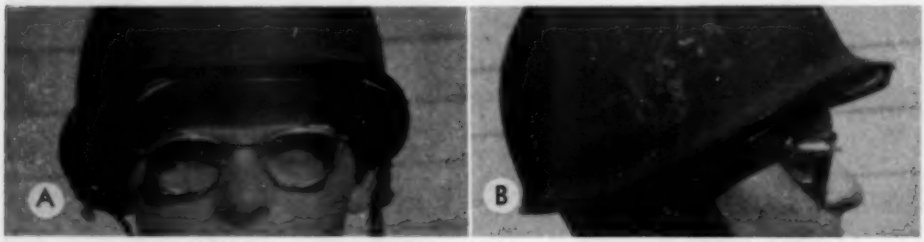

Fig. 5 (Fair). The spectacle type protective goggle in use with steel helmet.
(A) Front view. (B) Side view.

in considering the advantages and disadvantages of the various lens materials available. Plastic lenses are lighter in weight, have greater impact resistance, do not shatter, and show less tendency to fog. Their one great disadvantage is their lack of scratch resistance. Scratching of plastic lenses can be avoided by careful wear and handling but these niceties cannot be expected of a soldier. The hardest plastics do not compare with tempered (casehardened) glass in this respect and probably should not be considered for use in eye armor. Tempered glass lenses are heavier and conduct heat more readily so that there is a tendency to fog if adequate ventilation is not provided. A disadvantage of glass lenses is the possibility of shattering with the setting up of secondary missiles. This undesirable characteristic does not outweigh their resistance to scratching, however, so that, everything considered, hardened glass lenses should be selected over plastic. The future development of harder plastics may change this situation entirely. Conceivably, a combination of plastic and glass in laminated form would eliminate the objectionable features of each (fig. 6). For the time being, tempered glass lenses meeting Federal specifications will provide the soldier with a high degree of protection.

Some provision would have to be made for the soldier who required correction of a refractive error. This raises the whole question of supply and replacement of spectacles and lenses. Supplying frames and plano lenses does not pose much of a problem. Perhaps nine out of 10 soldiers would need only plano lenses if unnecessary minor corrections were eliminated. Ideally, combat soldiers should be chosen from among those whose uncorrected vision and other physical features are good, but man-power limits compel the use of less strict standards so that corrective lenses would have to be made available. This would mean the addition of a tempering unit to the optical facilities supporting troops in forward areas along with

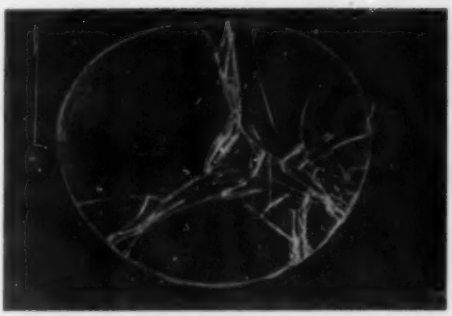

Fig. 6 (Fair). Laminated glass and plastic lens. The setting up of secondary missiles from the fractured outer and inner glass layers is prevented by a middle layer of plastic.

a second entire stock of lenses. Bulky equipment of this sort is a real objection to an already overburdened army but should pay for itself in manpower saved. As far as the monetary cost of the entire program is concerned, it probably would be less than the total cost of lifetime pensions for soldiers blinded in one or both eyes.

Other questions are sometimes raised in connection with eye armor. Tinting of lenses to reduce the effects of glare is an attractive thought but this would prevent their wear after dark. Some feel that the absorption of the usual six percent of visible light by untinted glass would handicap the soldier on guard at night or on night patrol.

Protective spectacles would have to be worn only a small part of the time anywhere but in field training or actual combat. This situation calls for a carrying case that would fit either in a pocket or on the belt. Attaching the frame to the steel helmet is impractical because the helmet is so unstable on the head.

This discussion of the difficulties connected with the use of eye armor has been kept brief deliberately for fear of giving the impression that they are numerous or insurmountable. The development of eye armor has been delayed long enough by misinformation and inexpert advice. There is no doubt that the greatest number of the missiles which caused the eye wounds seen in

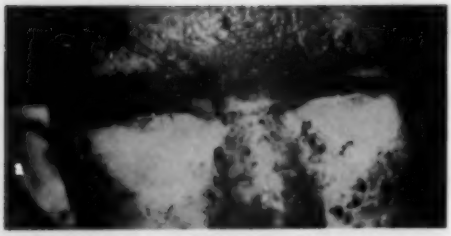

Fig. 7 (Fair). Protection of the eyes afforded by ordinary crown glass lenses in front line explosion.

World War II and the Korean war could have been stopped by tempered glass lenses. This statement is based on clinical impression, it is true, but all should agree that particles that are brought to a halt by the soft tissues of the eye and orbit could surely be deflected by the lenses that have been described.

Figure 7 shows the protection afforded by nothing but the crown glass lenses in ordinary spectacles. This soldier undoubtedly would have suffered severe damage to his eyes if his glasses had not protected him. The real problems foreseen have nothing to do with the ability of the lenses to deflect small particles. Making the soldier wear his goggles at the proper time is much more likely to be troublesome. Actually, every difficulty which might arise has already been experienced in industry and direct use can be made of the lessons learned.

It is likely that thought and effort concentrated on the problem of protection of the eyes in soldiers would result in more acceptable or more effective eye armor than that recommended here. Experiments simulating combat conditions would yield worthwhile information as to ballistic value, scratch resistance, shattering and light absorbing characteristics of the various lens materials. Better frames could probably be devised. But the use of eye armor, or the provision for its general use, should not await the results of such studies. The crux of the matter is the clinical belief that the tragic loss of eyes in modern warfare could largely be prevented by the use of presently available protective devices.

What is needed is a combined effort involving a large number of troops, preferably trainees, in whom the use of goggles could be studied. Teamwork by ophthalmologist and optician would be required in determining visual acuity in each soldier-subject, correction of refractive errors, and proper fitting of frames. The training period, which closely simulates combat conditions, could be used in studying the characteristics of the various lens materials, the durability of the frames and the effect of goggles on performance. Out of such an investigation probably would come numerous improvements.

No matter how warfare may change, protection of eyes will remain a real problem. Provision for that protection should be made now rather than after any new outbreak of hostilities.

Summary

The increased use of the fragmentation type of explosive weapon seen in World War II and the Korean conflict caused an increase in wounds of the eye in combat troops. The recognition that most of such wounds were produced by very small shell fragments that had force enough to penetrate only the lids and the coats of the eye suggests the use of the ordinary safety goggle that has proved so effective in protecting the eyes of industrial workers. The particular protective device that is recommended is the spectacle type goggle with tempered glass lenses and side shields. It is believed that eye armor of this kind would greatly reduce the number of ocular injuries in combat soldiers. The only real problems foreseen are making the goggles acceptable to the soldier who has never before worn spectacles and providing corrective lenses for the soldier with a significant refractive error.

Medical College of Georgia.

SAFETY ON THE HIGHWAY

A PROBLEM OF VISION, VISIBILITY, AND COLOR

FABER BIRREN
New York

The whole of America rides on wheels. Out of a population of 168,000,000 it operates about 56,000,000 motor vehicles, one for every third citizen.

The enormous toll of human life and limb constitutes the largest and most serious problems of safety in the country. In one year there are about 40,000 deaths and 1,350,000 injuries. The total cost to the nation is in excess of four billion dollars annually.

Except where there may be outright mechanical failure or so-called "acts of God," most automobile accidents may be attributed to faulty vision and perception and to reckless emotional and psychologic attitudes. In other words, the driver doesn't see clearly, his judgment of distance, speed, and orientation to hazard are faulty, or he just does not care!

THE GESTALT OF SEEING

As the psychologist W. Kohler has written,* "The sensory and the motor system are not two separate systems, merely connected by communication pathways. They are parts of one comprehensive system." The whole *gestalt* of safety on the highway involves many complex interrelationships: the ability to see; the speed and direction of voluntary and involuntary reaction to what is seen; good sensible judgment; emotional and psychologic attitude of the driver toward himself and the world beyond. Put them all together and the problem to be met begins to resolve itself.

There must be safe roads and safe automobiles, stringent traffic regulations, careful driver screening and training, adequate eye examination and testing, car inspection, education, and enlightenment on human responsibility.

VISION AND VISIBILITY

Since my training has been in the fields of vision, color, and safety, my concern with highway traffic and accidents centers around these factors. Because the simple art of seeing is perhaps a dominant factor in the protection of life and limb, there is good reason to study and restudy various practices followed today, such as in roadway markers and highway signs.

Since 1942, American industry has worked successfully with a co-ordinated safety color code which, in many instances, has lowered accident frequencies. This has been previously reviewed by me, together with various other notes on brightness, visibility, and the over-all requirements of safe and efficient seeing.†

Much that has been accomplished in industrial plants through capable research and trial may be transferred to the field of highway safety. While conditions on the open road may not be directly comparable with those encountered in a factory, none the less the same public is involved and sound principles developed elsewhere may be taken out on the highways.

HUMAN SIDE OF COLOR

It goes without saying that good vision is a chief factor in highway safety. Yet it is one thing to be able to see and another thing to be affected or stimulated by what is seen. Here is where color has dynamic use and where its benefits have been most effective in safety work. For color in vision adds a

* *Gestalt Psychology*. New York, Liveright Publishing Corporation. 1947.

† The ophthalmic aspects of illumination, brightness, and color. Tr. Am. Acad. Ophth., May-June, 1948; An organic approach to illumination and color. Tr. Am. Acad. Ophth., Jan.-Feb., 1952.

Fig. 1 (Birren). The railroad semaphore. Over a generation ago careful research established red as the color of highest recognition, followed by green, then yellow, with white fourth. Here is the forerunner of the modern traffic signal. (Photograph courtesy of Association of American Railroads.)

necessary force of compulsion to the visual process. It commands attention, arouses interest and pleasure, and seems to work its way deep into consciousness.

Although somewhat afield from safety, consider the human "impact" of color in the everyday experiences of shopping in a supermarket or reading magazine advertising. In the supermarket, for example, it is conceivable that all packages in black and white would be quite visible. Yet color is introduced for purposes of outright attraction. Researchers estimate that fully 60 percent of purchases are on an impulse basis, and much credit goes to color for stimulating desire in many things not on the shopper's list.

In advertising, where the cost of color is expected to pay a profit, a great amount of research is constantly undertaken. Based on studies of black and white advertisements versus colored advertisements, fully 50 percent greater readership and memory retention have been demonstrated. In other words, people—you and I—pay more attention to the colored pages and remember them better.

If in these simple, human experiences, color is found to prod attention, then it should produce similar results on such devices as highway signs.

Research in visibility

A review of research on traffic signs reveals general agreement of a number of points. Yet the whole problem—from the highway safety standpoint—by no means rests with legibility alone or extreme contrast.

Here is a subject very familiar to me. By and large, good legibility is a direct function of size and contrast. In studies conducted many years ago by Ferree, Rand, and others, where there are conditions of extreme brightness (as during a sunny day), white on black holds certain advantages because it tends to control glare. A large white area may cause letters and images to appear blurred and may produce a temporary blindspot on the retina, particularly under full sunlight. In darkness or dim light, black on white is desirable because it sets up a bigger target and is easier to seize upon visually.

Such facts are more or less academic. Many tests of visibility and legibility, however, are conducted under controlled conditions in which (a) the observer's attention is fixed, and (b) he approaches the sign slowly. Such a situation is not very typical of average driving in which there are countless distractions, high speed, and a wandering eye and mind.

There is a further and mighty important factor derived from studies in industry. No average mortal is likely to take any sign seriously when what it has to say lies on the threshold of his vision (when the message is barely visible). He will wait until he gets reasonably close. Therefore, before the sign serves a practical purpose at all, it must itself be found and located!

Having this preliminary need in mind (to find the sign, even before it is or can be read), the value of color begins to loom large.

Need for recognition

A generation or more ago the railroad industry conducted a number of tests which led to the use of such colors as red, green, yellow, white for signals. This research, incidentally, was adopted later in the red, yellow, and green traffic signal, the standards being the same as those of the Association of American Railroads.

The job of the railroad engineer, obviously, was not only to see lights or objects along the right of way, but to be able to recognize and identify them with minimum difficulty. This research led to the accepted fact, that in recognition red was the color of first importance, then green, then yellow, with white fourth. In other words, while white might be a color of high visibility, it tended to lack impulsive attraction and psychologic interest.

Fig. 2 (Birren). Some 86 percent of drivers saw nothing unusual about this sign. Primary reaction was to color and shape, with the legend secondary.

Red and white "tops" sign

In the preparation of this report I have conducted two special studies which I am happy to review. (These first efforts will be supported later by further analyses to be undertaken through the kindness and voluntary co-operation of traffic engineers.)

Many behavior habits of human beings are rather automatic in nature and frequently they circumvent mental effort. Not many persons will know the number of steps in his house from the first to the second floor, even though he may climb them hundreds of times. On what side of his head does a man's best friend comb his hair? What a person may see time and again may not be mentally scrutinized in much detail. What is unimportant may be perceived and forgotten.

In a first study, a conventional stop sign in red and white was placed in a prominent location with the letters rearranged to read TOPS. Under the assumption that a stop sign registers primarily for its color and shape, it could be expected that few persons would note anything unusual.

This is precisely what happened. After passing the sign, 100 drivers were questioned. Of these, 86 percent admitted that the word TOPS had been overlooked. Habitual drivers along the road took less notice (87 percent) than strangers (79 percent).

To expect average mortals to think continually in the process of seeing will seem quite contrary to human nature. In industry bright colors will mark danger spots far more effectively than will signs containing words and legends. The reason is simple enough, for visual reaction to color is involuntary, while words require deliberation.

Restudy of color and legibility

In a second study, the general subject of legibility was reviewed. Here four reflectorized signs (white on red, black on yellow, black on white, white on green) were prepared, using eight inch letters on an octagonal panel. The test was designed to check relative legibility, and to interpret the data in terms of realistic driving speeds. After all, any test of legibility, to be valid, should

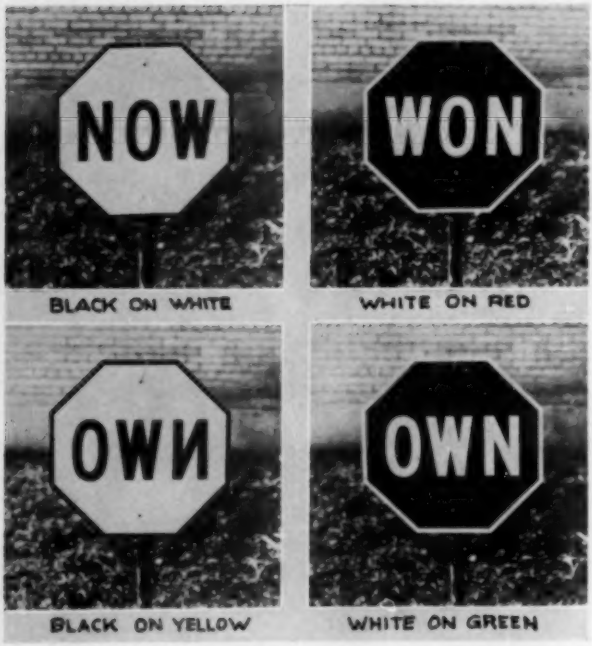

Fig. 3 (Birren). These four reflectorized signs were checked for relative legibility during the day and at night. Visual threshold points were only 0.627 second (day) and 0.395 second (night) apart at 50 mph.

consider the average facts of automobile driving and not be isolated from it.

In these four commonly used signs, all reflectorized, actual legibility (averaged among several observers) was as follows for both day and night.

DAYTIME LEGIBILITY

Sign	*Rank and Distance* (feet)
Black on white	1—404
White on red	2—361
Black on yellow	3—358*
White on green	4—358*

* These two signs had equal legibility.

NIGHTTIME LEGIBILITY

Sign	*Rank and Distance* (feet)
Black on yellow	1—341
White on green	2—337
Black on white	3—316
White on red	4—312

The above data more or less confirms previous legibility tests. On an average the signs were legible on night driving at 88 percent of the day viewing distance.

However, whereas black on white and white on red ranked first and second for daytime legibility, they ranked third and fourth for nighttime. The best night signs (reflectorized) were black on yellow and white on green.

ALL-IMPORTANT FACTOR OF SPEED

As has previously been mentioned, no average automobile driver will (or can be expected to) clearly read any sign on the exact threshold of visibility. He will first look for the sign and then approach it until what it has to say is readily visible.

The element of time is therefore significant. The sign will be read, not at the precise instant it is seen, but during the interval that follows.

In the legibility test described above are a few significant figures which would apply if a driver were proceeding at a speed of 50 mph.

1. During the day, the threshold points of the black on white sign (which ranks first) and the white on green sign (which ranks

fourth) would be 0.627 seconds apart—a mere heart-beat!

2. At night, the threshold points of the black on yellow sign (which ranks first) and the white on red sign (which ranks fourth) would be only 0.395 seconds apart!

In both instances the time element (at 50 mph.) is less than the 0.75 second "reaction time" so often mentioned in drivers' manuals as the normal moment of hesitation between an external visual stimulation and a physical reaction to it. After all, the driver will have about five seconds to read the sign from the time he first sees it until it is at right angle to his eye.

From the above facts it is perhaps fair to state that slight differences in the legibility of traffic signs are of no great consequence. If black on white has minor advantage, it would be impractical to keep adding more and more combinations of it anyhow, because clear identity and differentiation through color would be lost and a meaningful code sacrificed.

Review of existing standards

The four color schemes used in the above test are those recognized today and commonly found on traffic signs. All have good visibility. And all, to repeat, should be reflectorized or illuminated in order to assure general high brightness at night and a uniform day-night appearance.

The red and white STOP sign: The combination of white on red has lately replaced black on yellow in STOP signs. The use of red solely for this identification is perhaps sound, for red is a color of high recognition and impulse attraction (although it may lack distinction to a low percentage of color-blind men).

Black on yellow warning signs: Here again the choice could hardly be improved. Black on yellow in warning signs follows capable research undertaken many years ago. In both visibility studies and legibility studies, yellow has outstanding advantages. Because of its color it has more impulse attraction than achromatic white. In exceedingly brilliant daylight it is less likely to show glare. Yellow reflects in the high visibility region where visual acuity is keen and where areas, forms, and images are sharply focused. (Yellow eyeglasses, which are commonly worn by pilots, gunners, and sportsmen to lessen the glare of full sunlight and overcome chromatic aberration in the eye, actually make for clearer vision despite the amount of light absorbed by the yellow filter.)

Case against black

Black on white regulatory signs: This combination, though commonplace, is probably satisfactory. As the number of highway signs increase, however, too much use of the combination may offer certain drawbacks of repetition and monotony.

Guide signs: My agreement with the above standard practices, however, comes to an end when and where black is recommended as a background for guide signs—or for the background of any traffic signs, in fact. In the "Manual on uniform traffic control devices for streets and highways," white on black is said to yield "better legibility than the hitherto standard black on white." It is suggested as an alternate combination for certain guide signs (Section 94), destination signs (Section 113), distance signs (Section 115), and information signs (Section 117).

A thorough investigation of research on color, visibility, recognition, and safety would seriously question black as a suitable color for sign backgrounds—despite the high legibility it gives to white legends or characters.

First of all, black is almost wholly passive in the process of seeing. In effect, it affords virtually no stimulation of the nerves in the retina of the eye. Second, it is emotionally negative, holding little visual, mental, or psychologic interest. Third, being "emptiness" or "nothingness," it is most difficult to focus. Like space itself, black is hard to localize or to judge as to distance. It therefore sets up a poor target, even though the letters placed upon it may be easily seen.

Fig. 4 (Birren). White on green has been effectively used for destination markers to assure attention and recognition by the motorist well in advance of vehicle turning points.

White on green sign

In my opinion, the funereal combination of white on black could well be abolished for a newer and more vital standard—white on green. This would apply to directional signs, destination signs, distance signs, and route markers, all of which are tied together as far as the motorist is concerned, for they all relate to his wish to get to a specific place. If red is for stop, yellow for caution, white for regulation or information, green would be a likely symbol to keep him moving safely, confidently, and without distraction from one place to another, and along the route he needs to take. Obviously the green should be reflectorized so that its night symbol would be identical with its day likeness.

Upon inquiry, I find that the white on green reflectorized guide sign (for direction, destination, distance, route) has been adopted on many turnpikes and freeways in Maine, New Hampshire, Rhode Island, New Jersey, New York, West Virginia, Kentucky, Indiana, Ohio, Kansas, Oklahoma, Florida, and so forth. For the practice—and the standard—to become national would seem to be quite desirable. Green as a color is second in recognition only to red. And because it is emotionally tranquil rather than impulsive, it would find a wholly logical and secondary sequence to red for STOP and yellow for warning or caution. It would further mark the driver's journey effectively and consistently, offering a difference in color from white which thereby becomes more or less exclusively reserved for regulatory and information purposes.

New era for color

There is, indeed, more to color than greets the eye. Additional research is needed, involving not legibility or even visibility alone but the whole dynamic *gestalt* of seeing.

In the classical literature of vision and color are any number of references to the primitive quality of color (over form and shape). Maria Rickers-Ovsiankina* writes, "Color experience, when it occurs, is thus a much more immediate and direct sense datum than the experience of form. Form perception is usually accompanied by a detached, objective attitude in the subject. Whereas the experience of color, being more immediate, is likely to contain personal, effectively toned notes."

After all, the useful "spectrum" for traffic purposes is extremely limited. The number of clearly distinguishable and different colors is few—red, green, yellow, white. Added to these might be orange, pink, blue, purple (none of which will be confused with the above), and the list is practically exhausted. In the future, the orange and pink might be introduced where high impulses are desired for some new and vital purpose. The blue and purple, however (both of which are difficult to focus and tend to form a blurred image), might be held for other and less important uses.

Let it be remembered that color speaks all tongues. People love it, remember it, and are able to hold mental visions of it without difficulty. Its beauty and emotional appeal are all to its credit. And where it is functionally applied to traffic control and safety, it is assured of a wholehearted human response.

500 Fifth Avenue.

* Some theoretical considerations regarding the Rorschach method. Rorschach Research Exchange, April, 1943.

MECHANISMS IN ANGLE-CLOSURE GLAUCOMA

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INTRODUCTION

In a previous article[3] I considered the resistance to deformation of the tissue of the peripheral iris, that is, the force arising in the peripheral iris by deformation which tends to restore the primary form, as a factor which affects the width of the angle space and of its entrance. I suggested that this factor may be of importance in the mechanisms of closure and of reopening of the angle in angle-closure glaucoma. The aim of this article is to try to show how this factor, in connection with other factors which affect the width of the angle, may be involved in these mechanisms.

The width and the whole configuration of the angle seem to be determined primarily by heredity. Any factor which affects the walls of the angle space may affect its width. The anterior wall formed by sclerocornea is rigid and rather constant in form and position.

Factors which affect it, for example, pressure from outside or conditions changing its thickness, will affect the width of the angle. The posterior wall of the angle space is more variable and its changes will be most important for the width of the angle. Volume and position of the ciliary body and especially the form of the iris and its position are essential in the configuration of the angle space. So the factors which determine the configuration of the angle space are numerous. Some of these factors are rather constant. They may cause a permanently narrow angle and may be factors predisposing to closure of the angle, for example, the primary depth of the anterior chamber and configuration of the angle, the resistance of the tissue of the peripheral iris to deformation. Other factors are more variable—the pull of the sphincter, the pressure on the hind surface of the iris. These factors may produce a temporary narrowing or closure of the angle and may be precipitating factors. The intention of this article is to give a schematic outline of the mechanisms involved in closure and reopening of the angle. Special attention is directed to the form of the iris, which seems to be of utmost importance in the origin and development of the pathologic condition which can be called intermittent or paroxysmal complete angle-closure glaucoma.

NORMAL FORM OF THE IRIS

The normal form of the iris is determined by its anatomic structure, the properties of its tissues which determine its resistance to forces acting on it, the action of the muscles of the iris, the forces acting on the surfaces of the iris, the volume and the position of the ciliary body influencing the position of the root of the iris, and the position of the anterior surface of the lens.

The structure of the iris is not uniform and its thickness and, probably, its resistance vary, being somewhat lower at the periphery and lowest at the root of the iris. The pupillary border zone of the iris rests on the anterior surface of the lens and is pressed to it by the contraction of the sphincter, causing a slight obstruction to flow from the posterior to the anterior chamber and so a slight protrusion of the whole iris—the physiologic bombé of the iris. At the angle the difference of pressure is minimally greater due to the outflow just in front of the peripheral iris and the region of the main inflow just behind it. The lower resistance of the peripheral iris causes a secondary protrusion of the iris situated at the far periphery (fig. 1). This protrusion is very slight in the normal eye. The resistance of the peripheral iris may vary individually and may change with age or be influenced by pathologic conditions.

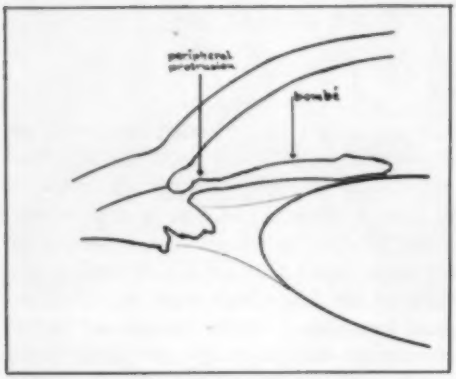

Fig. 1 (Kessler). Schematic drawing of a normal iris.

Form of the Iris in Narrow Angle

The form of the iris in narrow angle may be normal and the narrowness of the angle may be a part of the shallowness of the whole anterior chamber. In many cases of angle-closure glaucoma, the iris shows an abnormal degree of protrusion. Barkan[1] in his investigations of the form of the iris in angle-closure glaucoma notes cases in which no bombé is found, but the angle is obstructed by the last fold of the iris and in which basal iridectomy is successful. He also notes the not too rare cases with normal axial depth of the anterior chamber and with narrow or closed angle. It seems difficult to explain these forms of the iris by increased physiologic bombé without considering the less conspicuous peripheral protrusion.

The peripheral protrusion seems to be increased in many cases of angle-closure glaucoma, possibly due to a subnormal resistance of the peripheral iris. Contraction of the sphincter increases the physiologic seclusion but decreases the peripheral protrusion by stretching the whole iris; relaxation of the sphincter decreases the physiologic seclusion but increases the peripheral protrusion, this protrusion being less antagonized by the pull of the sphincter.

The less resistant peripheral part of the iris may be more protruded by a smaller force if the stretching in the plane of the iris is reduced (fig. 2). With contraction of the sphincter, the protrusion of the iris decreases by stretching and increases by increased difference of pressure.

The factor of stretching may be of more effect on the thinner peripheral iris, resulting here in a decreased bulging. With relaxation of the sphincter the reduction of stretching may have more effect on the peripheral iris than the reduction of difference of pressure, resulting in increased bulging of the peripheral iris.

With contraction of the pupillary sphincter, both the pressure acting on the iris and the resistance of the iris increase; with relaxation of the sphincter both forces decrease. However, the degree of change of these forces is different and the degree of change of resistance may be different in the different parts of the iris.

The primarily smaller distance of the peripheral iris of the hyperopic eye from outflow and inflow may increase the—to be sure minimal—effect of these factors on the peripheral iris.

The peripheral protrusion seems to increase progressively in the course of the disease due to decreasing resistance of the

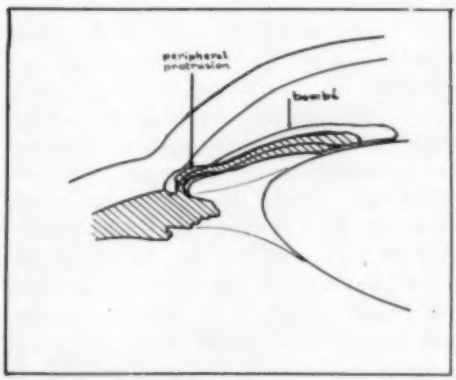

Fig. 2 (Kessler). Schematic drawing of the form of the iris in the presence of a narrow angle, and the change in the form of the iris with change of action of the pupillary sphincter.

peripheral iris, which undergoes progressive atrophy. The angle is narrowed progressively. These eyes are seen usually under the effect of miotics, and the reduction of the peripheral protrusion in miosis may divert the attention from the protrusion, which in relaxation of the sphincter may close the angle.

The forms of the iris as found by Barkan seem to corroborate the concept proposed. Elschnig[2] describes the findings in anatomic examination as a saclike space between the ciliary processes and the peripheral iris, like a new extention of the posterior chamber formed by the peripheral iris, extending toward the trabecula.

The change of the form of the iris with relaxation of the pupillary sphincter is the usual precipitating factor in paroxysmal angle-closure glaucoma, the angle being closed by increased bulging of the peripheral protrusion. Other incidental precipitating factors may be rapid increase of volume of contents of the eye behind the iris or rapid decrease of volume anteriorly to the iris.

Closure and reopening of the angle

The following is an attempt to outline, in connection with the concept discussed previously, the mechanisms involved in closure and reopening of the angle in paroxysmal complete angle-closure glaucoma.

Closure of the angle usually starts as a circumferential contact between iris and cornea at the entrance of the angle space. Compression of the separated ring space follows, due to the increased difference of pressure acting on the peripheral iris which forms the back wall of the ring space. The pressure in the posterior chamber is increased due to obstruction of the outflow, while the pressure in the ring space separated from the main part of the anterior chamber decreases toward the pressure in Schlemm's canal. This difference of pressure is too high to be balanced by the force arising with deformation in the peripheral iris and the ring space is compressed.[3]

By this compression, the root of the iris is pressed into the niche formed by the internal scleral sulcus and the anterior surface of the ciliary body (fig. 3). A marked deformation of the root of the iris occurs, which is the more extensive, as the root of the iris contains only the posterior layers of the iris, which are pressed anteriorly. The extent of the deformation depends on the anatomic features of the angle.

This deformation of the root of the iris leads to some degree of vascular strangulation affecting the veins and even the arteries of the iris. Strangulation of veins and stasis in the capillaries of the iris lead to malnutrition and damage of the capillary endothelium, with outpouring into the anterior chamber of a hypotonic fluid different from the normal aqueous in its properties and its oxygen content.

The nutrition and the respiration of the corneal endothelium probably partly depend on the supply by the aqueous; and impairment of the corneal endothelium by the change of the aqueous in the anterior chamber may be mainly responsible for the corneal edema in this type of glaucoma which occurs at lower tension than in open-angle-glaucoma. A higher degree of strangulation may affect the veins of the iris ex-

Fig. 3 (Kessler). Schematic drawing, showing compression of the angle space and deformation of the root of the iris.

tensively, as well as the arteries, causing necrosis of tissue, inflammation, and consecutive scarring.

Repeated attacks of closure of the angle in the early stage of the disease usually subside without any treatment after a relatively short time. This seems to point to a definite mechanism of reopening of the angle. Accidental changes in the pull of the sphincter, for example, parasympathetic preponderance in sleep, may cause reopening. The regularity of repeated reopening in many cases in the early stages suggests a factor in reopening inherent to the attack itself.

This factor could be the pressure of the fluid pouring out from the congested capillaries into the anterior chamber and opening the circular adhesion at the entrance of the angle or a part of it. The opening of a part of the entrance of the angle space is followed by entrance of fluid into the ring space, with a pressure which, together with the force in the deformed peripheral part of the iris (the posterior wall of the ring space) quickly reopens the ring space. The fluid of the anterior chamber has access to the whole trabecula, so that the outflow returns to normal and the root of the iris regains its normal form and there is no more strangulation of vessels. The eye returns to normal, except for the damage caused by the attack.

The usual course of the disease, with repeated attacks becoming progressively more frequent, more severe, and more prolonged, seems to point to a definite pattern of progressive changes in the affected eye with increase of the factors which predispose to attacks and which precipitate them.

The tissues of the eye are damaged progressively and undergo progressive atrophy. Atrophic tissue is less resistant to the forces acting on it. Since it has lost its normal resiliency, it is distended by them, that is it loses its ability to regain its primary form. The peripheral iris becomes progressively distended, loses its resiliency, like the atrophic wall of a varicose vein, and may form a rather saclike protrusion.

In the course of the disease, therefore, the peripheral protrusion of the iris will increase progressively with progressive narrowing of the angle which, together with impaired action of the sphincter, will lead to increased frequency of angle closure; at the same time, the mechanisms of reopening of the angle will be impaired, resulting in less outpouring of fluid from the reduced vessels of the atrophic tissue of the iris, less resiliency of the root of the iris, and decreased facility of reopening of the angle space. Stasis in the blood circulation of the whole uvea in the later severe attacks will reduce the opening effect of fluid pouring out from the iris into the anterior chamber. Therefore, the attacks will become progressively more frequent, more prolonged, and more severe. The angle space will reopen more and more slowly, and only partly, finally not at all. Anterior synechias will develop, contributing to the closure of the angle.

Changes in the eye by iridectomy

By iridectomy the pressures in the anterior and posterior chambers of the eye are equalized—completely in the region of the iridectomy and almost completely in the rest of the chambers. The pressure in the anterior chamber increases slightly, while the pressure in the posterior chamber decreases. Basal iridectomy acts maximally on a part of the peripheral protrusion and prevents compression of the angle space, even if this space is separated completely from the main part of the anterior chamber by a circular adhesion at the entrance.[3]

It has been observed (Barkan and others) that the axial depth of the anterior chamber increases after iridectomy, the lens being moved posteriorly. These observations point to changes of pressure in the vitreous, due to iridectomy. The pressures in the posterior chamber and in the vitreous seem to be linked, possibly by a common control of the

formation of fluid in both spaces or because of passage of fluid from the posterior chamber into the vitreous by a very slow filtration. The decrease of the pressure in the vitreous accompanying the decrease of the pressure in the posterior chamber, together with the increase of the pressure in the anterior chamber, moves the lens posteriorly. Barkan observed a progressive increase of the anterior position of the lens in cases of angle-closure glaucoma, and suggests that increased physiologic seclusion is the causative factor bringing about the vicious circle of anteriorly placed lens and increased physiologic seclusion. As the physiologic seclusion is increased artificially in these eyes by miotics, the prolonged use of miotics could contribute to progressive shallowing of the anterior chamber. For this reason also, early iridectomy would seem indicated. Retroplacement of the lens after iridectomy has been observed.

Summary

1. There exist two physiologic protrusions of the iris—the physiologic bombé of the whole iris and a protrusion at the periphery.

2. The protrusion of the iris responsible for closure of the angle in angle-closure glaucoma is an accentuation of the peripheral protrusion.

3. With contraction of the sphincter, the peripheral protrusion decreases; with relaxation of the sphincter, it increases.

4. Definite mechanisms of closure and of reopening of the angle are postulated and suggested.

5. The course of paroxysmal complete angle-closure glaucoma is outlined schematically in connection with the concept herein developed.

6. The effect of iridectomy is discussed briefly.

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THE ROLE OF TRYPSIN IN EXPERIMENTALLY INDUCED HYPHEMA*

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Interest in trypsin as a therapeutic adjunct in inflammations and vascular disturbances of the eye[1-3] has followed its more securely demonstrated role as a proteolytic enzyme useful in certain closed space and surface debridements. Usual commercial trypsin (Armour Laboratory's Enzar, Tryptar, and Chymar; National Drug Company's Parenzyme) is derived from mammalian pancreas and certain species differences in this enzyme have been noted.[6,7] Trypsin has powerful fibrinolytic and mycolytic properties when acting directly. It apparently will digest desoxyribose nucleo-

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protein[8] and does not need enterokinase for activation.[9] Small polypeptides and amino acids are produced by its action.

General anti-inflammatory actions of trypsin are less clearly understood than its local or direct mechanism. The production of egg-white edema in rat leg tissue is not inhibited by trypsin pretreatment, but when trypsin is injected into the site of such edema there appears to be direct facilitation of drainage by (a) increased permeability, (b) vasodilatation, and (c) reduced viscosity of edema fluid.[10] That some of these actions may be general in scope is suggested by increased passage of penicillin across the blood-spinal fluid barrier in dogs treated with parenteral trypsin, compared to untreated dogs.[11] Similarly, subcutaneous or intraperitoneal injections of trypsin or chymotrypsin have been found to reduce edema of the extremities in albino rats consequent to intraperitoneal injections of dextran.[12]

Intramuscular and intravenous trypsin has had somewhat extensive trial in acute thrombophlebitis, yielding data on its role in vasculitis and its complications. Because it is a low (32,400) molecular weight protein its antigenicity is generally not great, although allergic reactions may be potentiated in the hyperallergic individual.[13] Histamine-like reactions (slight hypotension, tachycardia, and hyperpyrexia) may follow its parenteral use, especially when injected into closed spaces,[9] but both this and hypersensitive reactions may be minimized by antihistaminic premedication. Urticaria, chills, headache, intestinal, or chest pain occur but are more likely to follow intravenous than intramuscular use.[13] Pain at the injection site has been reported in about 30 percent of injections and induration may occur. Doses above 5,000 units or 1.6 mg./kg. may render the blood uncoagulable and produce death. Infusions of 10 mg. twice a day[12,14] may decrease prothrombin time (Quick method) by about 15 percent and slightly prolong coagulation time (Lee and White) but Golden[15] did not find this in 20 patients receiving 2.5 mg. of trypsin intramuscularly daily for four days. Blood clot viscosity may also be reduced from 10 to 30 centipoise units.[14]

Pure crystalline trypsin is stable indefinitely in the dry form at room temperature. In solution it is active between pH 5.0 and pH 8.0 with greatest activity at pH 7.0 but such solutions lose 40 to 50 percent of their activity in three to four hours. Sorensen's phosphate buffer (pH 7.1) has been widely used in aqueous preparations of trypsin.

Experimental

Because clinical observations of uveitis, anterior chamber hemorrhage, and mechanical trauma are inherently difficult to control and because conclusions from trypsin therapy in ocular problems have been controversial, an experimental study in guinea pigs has been conducted.

1. Procedure

Twenty-three adult guinea pigs weighing 620 to 1,000 gm. were used in two series of experiments to evaluate the effect of trypsin by (a) intramuscular injection and by (b) subconjunctival injection on experimentally induced anterior chamber hemorrhages.

Topical anesthesia was secured in the experimental eye by repeated instillations of 2.0-percent pontocaine. Guinea pig blood was obtained from four additional animals by cardiac puncture with a 22-gauge needle.* Immediately upon withdrawing the cardiac blood a sterile 27-gauge needle was placed on the syringe and injection was made into the anterior chambers of the experimental animals by a subconjunctival, translimbal approach. Elschnig fixation forceps were used against the bulbar conjunctiva to steady

* Because blood grouping has not been demonstrated in guinea pig cells or sera, it was felt reasonable to use blood from one donor animal in several experimental animals. Rogers, J. B., Van-Loon, E. J., and Beattie, M. F., J. Exper. Zool., **117**:247-258 (July) 1951, in a study of 80 animals from 27 families, were unable to detect any agglutination on cross matchings or antigenic variations in the bloods.

the globe during injection. No anticoagulants were used and, therefore, only two to four eyes were usually injected with one syringe of blood before coagulation began.

Trypsin* administration was started 12 hours after the induction of hyphema in both series of experiments. In the first series of 12 animals, six were given intramuscular trypsin and six animals served as untreated controls. In the second series of 11 animals, five were given subconjunctival injections of trypsin and six animals served as controls. Sketches of each anterior segment were made twice daily.

a. *Treatment schedules.* Fresh aqueous solutions of trypsin 10 mg./cc. were prepared immediately before the injections of each morning and then administered intragluteally at 5.0 mg. per kg. (to dose of 3.35 to 5.0 mg.) at 10:00 A.M. and 7:00 P.M. for seven days. Solutions were refrigerated between injections. In the series for subconjunctival treatment, a maximum volume of 0.4 cc. (4.0 mg.) was injected in each eye. Injections of any greater volume were found to leak back around the needle. This dosage appeared well tolerated during the first 24 hours after injection. Therefore the dilution of trypsin for the second injection was increased to 20 mg. per cc. (that is, 8.0 mg. per eye). These second injections provoked severe chemosis, and in two cases, necrosis of the overlying lid. No further injections were made.

2. Results

a. *Intramuscular treatment.* In the six treated animals, two showed complete absorption of blood bilaterally in 20 to 24 hours after induction; in two other animals blood began to absorb on the third day of treatment and was completely absorbed in one on the eighth day and in the other on the 10th day; in the remaining two animals absorption began on the fifth day and was completed on the 10th day. One animal developed a secondary hyphema on the fourth day of treatment.

In the six control animals not receiving trypsin, two showed complete absorption of blood bilaterally in 15 to 20 hours after induction; in two other animals blood was completely absorbed on the fourth day; in the remaining two animals absorption began on the third day and was completed in one of these on the eighth day and in the other on the 10th day. In one animal a vitreous hemorrhage was noted on the second day.

All of these animals, except one in the control group, developed mild to moderately severe postinjectional corneal haze interpreted as mechanical keratitis consequent to manipulation of the anterior segments. This was not appreciably lessened in the animals receiving trypsin.

b. *Subconjunctival treatment.* In the five animals receiving initial injections of 4.0 mg. in each eye, the medication was well tolerated with no chemosis or irritation. The hyphemas, however, persisted. The second injections of 8.0 mg. per eye were uniformly in a toxic range. Several animals appeared to be in a shocklike state with profound lethargy for several hours. All developed severe chemosis, diffuse and dense keratitis, and some developed a beefy purulent conjunctivitis. Two animals developed descemetoceles, and in a third animal one cornea was so hazy that the anterior chamber could not be observed. Among the animals with visible chambers, hyphemas were absorbed on the second day in four eyes, the third day in three eyes, and the eighth day in two other eyes. Chemosis gradually diminished and disappeared in 48 hours. In one animal a vitreous hemorrhage was observed on the eighth day.

In the six control animals not receiving trypsin, one eye showed absorption of blood on the second day, four eyes on the third day, two on the sixth day, one on the seventh, one on the 10th, and one on the 12th

* Kindly supplied in lyophilized form by William M. Swain and G. Victor Rossi, Division of Clinical Research, The National Drug Company, Philadelphia 44, Pennsylvania.

day. In one of these animals secondary hyphema appeared in one eye on the fourth day and in the other eye on the 11th day. All of these control animals, as in the intramuscular experiment, developed postinjectional corneal haze which generally began to clear between the fourth and the ninth day.

Conclusions

Intramuscular administration of trypsin (5.0 mg./kg.) in aqueous solution under conditions of this study was found to have no appreciable effect on the absorption of experimental hyphema in the guinea pig. Similarly the presence of postinjectional corneal haze (mechanical keratitis) was not appreciably altered in the treated animals as compared to the control animals.

Subconjunctival injection of aqueous solutions of trypsin (10 mg./cc.) in doses of 4.0 mg. in each eye is well tolerated both locally and systemically by the guinea pig but has no grossly appreciable first-day effect on the absorption of hyphemia. The maximum practical volume for subconjunctival injection in the guinea pig is 0.4 cc. Subconjunctival injections of 8.0 mg. in each eye are followed by severe general reactions and destructive chemical reactions locally but are associated with slightly accelerated absorption of experimental hyphemas.

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THE RELATIONSHIP OF THE CENTRAL VISUAL FIELD TO THE SPEED OF VISUAL PERCEPTION*

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Observation of the eye characteristics of children who have trouble in learning to read has shown that there is a higher incidence of central visual field restriction and slower speed of visual perception among them than in the general school population. This has suggested a probable relationship between these factors.

Earlier studies have shown that both the macula and perimacular areas in the retina are involved in reading and that the eye typically makes far fewer fixations per line of print than would be the case if each portion of each word or phrase had to be focused successively on the macula.

Since the eye fixates, takes in a certain amount of text during the fixation, and then moves on to a new one, the extent of the central field may influence the speed of perception in reading, by limiting the extent of line perceived at each fixation.

The same line of reasoning appears to have been followed by Hincks[1] who suggested that limitation of peripheral vision might have some relation to perceptual span.

The present study explored such a relationship. Measurements of the central field and the speeds of both object (picture) and word perception were made in 50 subjects, ranging in age from five through 17 years. The central fields were plotted with an ordinary campimeter, while the speeds of visual perception were measured with a tachistoscope and by a method previously described by me.[2,3]

Since the study was made particularly to explore the relationship between field restriction and the speed of visual perception in reading, only the horizontal diameter of the central field was considered, this being the part on which fall the images of words and lines of print.

The central visual field is considered to be the inner 30 degrees of the visual field. The field measurement values used in the study were as follows:

Uninterrupted 30 degree central areas were assigned the value of 0, and each 10-degree restriction as 1.0, so that a restriction of five degrees received the value 0.5; 20 degrees 2.0.

If prior assumptions are correct a 0 field would permit more to be taken in at a given fixation, while a 2.0 field would permit apprehension of a smaller amount, due to the smaller extent of responding retina and its central connections. This would imply the necessity for making more fixations per line of print and therefore resulting in slower, more mechanical reading. A considerably restricted central field could make necessary more than one fixation per word, especially in longer words. Such restrictions could influence the speed of perception. A person needing to make more than one fixation per word, for example, would fail on tachistoscopic tests until the exposure had been slowed sufficiently to permit him to do so. This is consistent with the clinical observation that exposure time must be longer for long words than for short ones.

The two sets of measurements of speed of perception were correlated with those of the central fields by the rank-difference-squared-method and marked correspondence was indicated by the coefficients, both of which were three points apart and each within the range of its probable error and that of the other. The coefficient of correlation for the speed of word perception and central field measurement was 0.68 ± 0.05, and that of the speed of object (picture) perception was 0.65 ± 0.05.

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To the extent that this study is representative, limited as it is by its comparatively small number of cases, the results indicate that central field restrictions vary directly with the speed of visual perception for objects and words in an appreciable number of cases.

It supports the results of an earlier study[4] that demonstrated smaller horizontal (and vertical) field diameters in a group of educational disability cases as compared with unselected and normal groups.

The probability that restrictions of the central field may tend to limit the speed of visual perception in both general vision and in reading raises the question of what can be done to improve the extent of the central visual field, when smaller than normal.

The earlier study, referred to in Reference 4, involved medical treatment of a number of cases of field restriction. Favorable responses to this were accompanied by an improvement in school achievement in most of the cases.

Restrictions of the visual field result from three main causes: (1) Congenital influences; (2) pathologic processes, and (3) hysteria. Congenitally restricted fields may improve with exercises for developing eye span. They involve the attempt on the part of the subject to take in as much as possible at a given fixation. When the condition is due to congenital defectiveness the outlook for improvement is less favorable than when due to maturational deficiency or retardation. In this type, time is on the favorable side and the process of maturing may, perhaps, be facilitated somewhat by the exercises.

Pathologic restrictions require medical treatment, which can be accompanied by eye-span developing exercises at the physician's discretion. My experience leads me to expect improvement in school work to follow a favorable response to medical treatment in a reasonably large number of cases. When medical treatment is concluded in such instances, there appears to be no contraindication to employment of eye-span exercises.

Hysteric restrictions differ from the others in their symmetrically round or tubular field tracings and in the spiral tendency often observed. The hysteric field does not exhibit the usual changes in size with the distance from the campimeter. An earlier study of tubular and spiral central fields in hysteria[5] showed that 83 percent of the unselected school children exhibiting such hysteric fields were failing in their work. Treatment of the hysteric field falls to the ophthalmologist, psychiatrist, or clinical psychologist who attempts to locate and correct the underlying cause of the hysteria.

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NOTES, CASES, INSTRUMENTS

USE OF DI-ISOPROPYL FLUOROPHOSPHATE

IN 0.01-PERCENT AND 0.025-PERCENT CONCENTRATIONS

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In the decade that has elapsed since Leopold and Comroe described their results with di-isopropyl fluorophosphate on glaucomatous eyes, more than 25 reports of its use have appeared in the American ophthalmic journals. From these reports and the experiences of ophthalmologists, this drug has established a place for itself in ophthalmology. Chief among the various glaucomatous indications for its use is aphakic glaucoma, whether or not the glaucoma existed prior to the removal of the cataractous lens. Chief among the various contraindications is narrow-angle glaucoma; it should never be used until gonioscopic examination shows the angle is open. Detachments of the retina have been reported after the use of di-isopropyl fluorophosphate. Vail has observed that the letters—DFP—also stand for "dangerous for people."

The concentration of this drug commonly used in ophthalmology is 0.1 percent though experimentally the concentrations have varied from 0.025 to 2.5 percent. The vehicle generally used has been peanut oil, and the new ointment has a mineral oil, polyethylene base. Di-isopropyl fluorophosphate in 0.1-percent concentration has controlled aphakic glaucoma in many eyes, making antiglaucomatous surgery unnecessary in them; in others, surgery has been postponed and in some surgery has nevertheless been required without delay.

Many of the patients in whom di-isopropyl fluorophosphate has been used complain initially of severe ocular pain and objectionable blurring but in the majority of these, the unpleasant symptoms subside after a few days. In those patients in whom they do not, the problem is presented of being able to control the ocular tension with a drug too painful to use or of using a miotic with less than adequate control which does not have these side effects.

One method of resolving this dilemma has been to use a weaker concentration of di-isopropyl fluorophosphate,* varying from 0.01 percent (which proved to be unstable) to 0.025 percent in various vehicles. Table 1 shows the course of events in nine patients (14 eyes) in which this was used. As noted in the column of preoperative miotics, nine eyes had glaucoma before cataract surgery. After the cataract extractions, miotics less powerful than di-isopropyl fluorophosphate failed to control the tension in each of these 14 eyes. (In many eyes with mild aphakic glaucoma pilocarpine nitrate or Carcholin does control the tension but such eyes are not considered in this series.) No concentration of di-isopropyl fluorophosphate prevents the necessity of glaucoma surgery in some cases; as shown in the table, despite its use three of the 14 eyes required one operation, one of the eyes required two operations, and one required three operations before control was achieved. In this small series, there was no significant difference between the intracapsular and the extracapsular cases in the need for postextraction glaucoma surgery. Only continued persistence on the part of the ophthalmologist and the patient will maintain useful vision in eyes with advanced changes of aphakic glaucoma.

* A supply of 0.01-percent to 0.025-percent Floropryl has been furnished our patients by the Sharpe and Dohme Division of Merck and Company according to the following schedule:
1952—0.01-percent ophthalmic solution (peanut oil)
1953—0.025-percent ophthalmic solution (peanut oil and also in sesame oil)
1954-1956—ophthalmic ointment (mineral oil and polyethylene)

TABLE 1

SUMMARY OF CASES STUDIED

Name & Sex	Age (yr.)	Pre-operative Miotic	Pre-operative Tension (mm. Hg)	Glaucoma Surgery before Cataract Surgery	Cataract Surgery	Use of DFP 0.01% & 0.025%	Glaucoma Surgery after Cataract Surgery	Corrected Vision (May, 1953)
P.J. (M)	75	O.D.—yes O.S. —yes	55 55	CS trephine, full iridectomy, 6/48 CS trephine, air bubble in AC, 6/48	Extracap., 3/49 Discission, 9/49 Extracap., 6/52 Discission, 3/53	DFP 4/52–5/56 (both eyes)		20/200 20/40
G.M. (F)	68	O.D.—yes O.S. —yes	22 25	CS trephine, 8/48 CS trephine, 8/48	Intracap, 1/51 Intracap., 2/51	DEP 1/54–5/56 (both eyes)	Iridencleisis, 7/51 Cyclodialysis, 4/53	20/80 20/40
J.B. (F)	71	O.D.—yes O.S. —yes	62 28	Iridectomy, 1/52 Iridencleisis, 12/52	Intracap., full iridectomy, sclerectomy, 12/53 Intracap., full iridectomy, sclerectomy, 4/55	DFP 12/52–5/56 (both eyes)		20/20 20/20
G.J. (M)	51	O.D.—yes O.S. —*	35		Intracap., 4/53	DFP 3/53–5/56	CS trephine, cyclodialysis, 2/55	20/80 (normal)
J.J.K. (M)	79	O.D.—no† O.S. —yes	20		Intracap., iridectomy, sclerectomy, 2/53, choroidal hemorrhage 2 days later—evisceration, 2/53	DFP 2/53–5/56		20/100 (removed)
S.L.W. (F)	90	O.D.—‡ O.S. —yes	30		Extracap. full iridectomy, sclerectomy, 1/53	DFP 3/53–5/56	Cyclodialysis, 5/55	(L.P.) 20/80
C.M. (F)	58	O.D.—§ O.S. —no	20		Extracap., 3/50 Discission, 3/52	DFP 10/51–5/56	Cyclodialysis, cyclodiathermy, 9/55, cyclodiathermy, 1/56	(none) 20/30
J.B.H. (M)	73	O.D.—no O.S. —no	22 22		Intracap., 5/49 glaucoma developed 2 yr. later—cause unknown. Intracap., 5/48 (no glaucoma)	DFP 11/51–5/56		20/20 (20/40)
S.S (F)	58	O.D.—no O.S. —no		(aphakic glaucoma developed after cataract surgery, 3/54) (glaucoma discovered 2/55)	Extracap., 9/49 Intracap., 4/54	DFP 2/55–5/56 (both eyes)		20/20 20/20

* Normal—neither cataract formation nor glaucoma.
† Extracap. elsewhere and aphakic glaucoma undiscovered, but found on my first exam.
‡ Advanced glaucoma, no useful vision.
§ All vision lost from glaucoma secondary to severe uveitis prior to my first exam.

We have entered the acetazoleamide (Diamox®) era and new methods of combining this drug with various miotics are now being developed for many types of glaucoma. However, there will still be an occasional eye with aphakic glaucoma which can be controlled only with di-isopropyl fluorophosphate. In some of these, the 0.1 percent will cause continued intolerable symptoms and there may be a few of these eyes which can be successfully managed with the 0.025 percent concentration.

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VISUAL FIELD STUDIES

In a case of familial poor vision

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(With comments by the late
Dr. Stephan Polyak)

A white woman, aged 21 years, first became acutely aware of deficient vision four years ago.

When I first examined her, the vision in her right eye was 20/200 and in her left eye 20/100. No refractive error was found and no abnormalities were noticeable in either globe. The pupillary responses to light and accommodation were entirely normal. The inner eye was also normal, with the exception of the maculas and nerveheads, both of which exhibited slight variations.

The maculas had a slightly blotched appearance, while on examination both foveolas reflected more light than usual. Both optic nerves also appeared more pale laterally. The peripheral field of vision did not appear unusual; however, a central scotoma extending three degrees from the fixation point was present in both eyes. This no doubt corresponded to the blotched appearance in both macular areas. The diameter of the target used in this examination was two mm. Further examination of the color fields, using large 10-mm. red and green targets, produced no results (fig. 1-A).

The family history was of interest because her mother and also her twin 17-year-old brother and sister were troubled with poor vision.

Her brother's vision was only 20/40 in both eyes after correction of his myopia. His fields of vision were normal for white, red, and green. The only visible abnormality was a stronger light reflex emanating from the foveolas.

The twin sister's foveolas were like her brother's. In addition, one macular area appeared slightly blotched in a manner somewhat similar to that of her older sister's. Her fields of vision were also contracted but vision was found to be 20/30 in either eye after her myopia was corrected.

Further blood and neurologic examinations of these three members of the family were entirely normal.

The older sister, whose vision was much poorer than the twins, was of chief concern. Therefore treatment was started on her. The intent of this medication was to increase the metabolism of the retinal and other nervous tissue. The first week resulted in an improve-

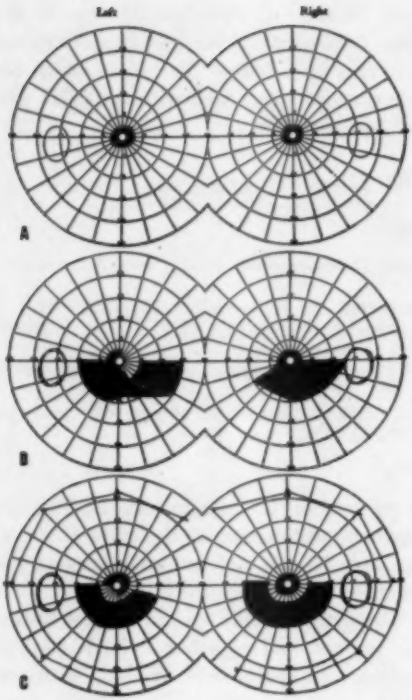

Fig. 1 (Poser). Visual fields (A) on October 21, 1954, (B) on October 28, 1954, one week after treatment was started, and (C) on December 17, 1954.

ment of the vision in the left eye to 20/30 while the right eye increased to 20/65.

The medial portion of the left central scotoma also disappeared (fig. 1-B). However, the most interesting observation to me was the return of a band of red vision, as indicated in the inferior field of either eye. This semicircular field terminated on either end at the horizontal meridian.

The reason for this red field terminating as it did in either eye is probably due to increased nutrition in the adjacent macular area. Whether the cones, the bipolar cells, or the ganglion cells were most benefited, I do not know. However, it was of interest to demonstrate the improvement (fig. 1-C) in this case of familial poor vision by increasing the metabolism of the nervous tissue and also to find that the improvement in distant vision occurred at about the same time as the reappearance of color vision.

Dr. Stephan Polyac has kindly consented to discuss this interesting case.

Comment (Dr. Stephan Polyak)

Having for a long time been interested in the anatomic organs of vision, Dr. Poser's case offered me a welcome opportunity to interpret the accumulated knowledge in anatomic terms.

The location of the central scotomas, their absolute character or loss of perception both for white and for colors, their small size, and the fact that they are present in both fields of view seem to indicate an involvement of the foveomacular bundles on both sides. Slight changes in the maculas and a slight temporal pallor of the optic papillae would agree with this.

Since the most complete functional defect was in the very centers, being eccentrically surrounded by a belt of relative scotomas for colors, this could be interpreted as a process beginning in the very centers of the fields at the fixation points and gradually involving the fibers supplying the region immediately encircling the fixation points. The indications point toward a spread of the process on to the fibers farther away from the fixation points, the earliest manifestation of this being impaired color vision.

The localization of the process is the next problem. The fact that the defect has no clear hemianopic character makes it practically certain that it does not affect the suprachiasmal portion of the visual pathways and centers. For beyond the chiasm the right and left halves of the fovea-macular fibers are far apart, except at the points of the two occipital lobes of the brain where the hemifoveas are projected. The absence of any symptoms indicating a cerebral pathology practically eliminates this possibility. Another localization, also unlikely for the same reason, would be a damage to the upper por-

tion of the chiasm just underneath the infundibulum of the between brain where the two decussating fovea-macular fibers are located.

The preceding anatomic considerations force one to accept the peripheral pathology, below the chiasm, that is, in the optic nerves, or in the eyes, or both. The ophthalmoscopic changes, no matter how slight, would tend to corroborate this assumption. The slightly saturated color of the central foveas may be interpreted as being due to a slight atrophy of the nervous tissue in the very area of the foveal excavation because of which the dark choroid pigment became more apparent. Likewise the slight temporal pallor of the optic papilla would be caused by an atrophy, perhaps also a partial disappearance of the optic nerve fibers which at that very locality pass over from the central fovea to the papilla. The reduction of the overlying fovea-macular fibers would make the cribriform lamina more apparent here.

It is obvious that any clear opinion about the pathologic process in this case could be had only on the basis of good histologic examination. This alone would tell us, perhaps, whether there was any definite cause, such as a chronic inflammation, inducing the atrophy of the fovea-macular fibers, or whether the cause was more subtle —one that could be defined as an inherent constitutional weakness of the delicate fovea-macular fibers. Also, this would show whether or not there was any local pathologic change in the region of the central fovea, an area which could be made responsible for such localized change. Other sidelights could illuminate the relation between the various elements of the visual system such as the cones, bipolars, and retinal ganglion cells.

30 North Michigan Avenue (2).

FAMILIAL DYSAUTONOMIA*

REPORT OF CASE WITH STIMULATION OF TEAR PRODUCTION BY PROSTIGMINE®

IRVIN S. PILGER, M.D.
Long Beach, California

In 1949[1] attention was first called to an apparently unrelated but recurring collection of symptoms. Subsequently, several additional reports have appeared, notably by Riley and his associates,[2,3] which have established the syndrome as a new entity which they term familial dysautonomia or familial autonomic dysfunction. As described by Riley, the features which are almost invariably present are (1) Jewish ancestry, (2) emotional instability, (3) inco-ordination, (4) defective lacrimation, (5) skin blotching, (6) excessive perspiration, (7) drooling, (8) and hyporeflexia. Not so constantly present are other features such as hypertension, cyclic vomiting, frequent unexplained fevers, frequent pulmonary infections, and corneal ulceration (the latter in about 35 percent of cases). It is emphasized that all of the findings need not, and usually do not, occur in any one individual. One case has been reported[4] which occurred in a non-Jewish child. References in the ophthalmic literature have been infrequent. An excellent review was presented by Dunnington[5] in which he discussed management of the corneal complications which may occur.

Pathologic studies to date have not revealed the exact histopathology. Autopsy studies on two cases were not significant. Apparently the condition is not incompatible with long life and it is expected that more cases will be recognized as familiarity with the syndrome grows.

This is a report of a case of familial

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* From the Division of Surgery, Department of Ophthalmology, University of California at Los Angeles, Los Angeles, California, and the Los Angeles County Harbor General Hospital, Torrance, California.

dysautonomia with special emphasis on the eye abnormalities.

Case report

The patient was a small, pale, Caucasian girl, aged nine months, holding her head up fairly well, but unable to sit up unaided. She did not grasp at the light, but only followed it with her eyes. She did not smile.

Skin. There were numerous pustules and vesicles over the nape of the neck, both axilla, left zygoma, and right interdigital spaces, as well as over the diaper area.

Head. There were prominent superficial veins. The anterior fontanel was open (1.0 by 0.5 inches) but not bulging. The ear canals were clean, drums intact, and physiologically normal. The nose appeared essentially normal. There was continued rolling of the tongue.

Neck. The neck examination was essentially negative. There was no adenopathy.

Chest. The lungs were clear to percussion and auscultation. The heart had a regular sinus rhythm of 152 per minute. No murmurs were heard. The apex was percussed to the fifth interspace at the midclavicular line on the left.

Abdomen. The liver was down one finger's breadth; the kidneys were palpable but not enlarged. There were active bowel sounds.

Neurologic. The reflexes were slightly sluggish. The sucking and swallowing reflexes were normal. The muscle tone was good.

The patient was referred to the eye service for study of the eyes and adnexa.

Eye examination. The infant was obviously undernourished and underdeveloped. She cried lustily but despite this no gross tears were evident. However, a fine moist film could be seen on the cornea. The lids were normal but the eyes appeared somewhat large in relation to the size of the head. The upper lids were slightly retracted, the lower margin being just above the upper limbus in both eyes. The pupils reacted well to light and the child followed objects very easily. The extraocular motility was normal.

Fluorescein was instilled in the eyes and the corneas were then examined with a loupe. No corneal staining was observed in either eye. Corneal sensitivity seemed normal although precise evaluation was difficult because of the age.

The pupils were then dilated for funduscopic examination. The media were clear. The discs showed the slight pallor normal for infants, and the retinas and vessels were otherwise normal.

The following day, without previous anesthesia, the Schirmer test was used to measure the secretion of tears. Both eyes measured three to four mm. which is well below the normal values. When Prostigmine® (0.25 mg.) was injected subcutaneously, grossly visible tears formed in each eye. This would suggest a defect in nerve conduction as the underlying pathologic process.

Comment

The eye examination in this case of familial dysautonomia revealed only some prominence of the eyes as well as a relative alacrima. As more of these cases are recognized, either in infants or in adults, perhaps other eye findings may be consistently related to this syndrome. Corneal ulceration and hypesthesia have already been described.

In further consideration of this case, one is reminded of Adie's syndrome. In his review[6] of that condition, Scheie postulated the lesion as consisting of a partial parasympathetic denervation at, or peripheral to, the ciliary ganglion. On the basis of this he devised the well-known test of mecholyl instillation in the eye with the dilated pupil. In the weak strength usually used, this constricts the dilated pupil, but is ineffective in the normal pupil. Perhaps use of mecholyl or Prostigmine® as described by Kroop[7] may eventually prove successful as a diagnostic test in dysautonomia. Studies are under way at present to

determine minimal amounts needed to produce tears in both dysautonomic and normal infants.

Adie himself, in one of his articles[8] on the subject, stated that he thought the pupil involvement might be due to disease of the vegetative nervous system, resulting in myotonia. Although no pupillary abnormalities have thus far been described as typical of dysautonomia, the hyporeflexia is prominent in both. Might not Adie's syndrome be a residual finding in cases of dysautonomia that survive to adulthood? Or could Adie's syndrome be a late manifestation of the same disease?

117 East Eighth Street (13).

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NEOVASCULARIZATION OF THE CORNEA

Due to Butazolidin® toxicity*

Louis F. Raymond, M.D.
East Orange, New Jersey

Butazolidin® (phenylbutazone)[1] may cause reactivation of latent peptic ulcer. It may be pointed out that, when a history of peptic ulcer is elicited, phenylbutazone is contraindicated.

The following case illustrates reactivation of a latent healed corneal ulcer, probably due to the same process involved in the activating of a peptic ulcer. Kuzell, et al.[2] reported ulcer activation in one percent of their cases of duodenal ulcers.

Case report

A white man, aged 57 years, gave a history of being treated for a corneal ulcer in the right eye prior to antibiotics. The left eye showed amblyopia ex anopsia. The right eye has remained asymptomatic for over 20 years.

The first examination in September, 1953, showed vision without glasses to be: R.E., 20/70; L.E., 20/300. Slitlamp examination of the right eye showed folds in Descemet's membrane. His best correctible vision in the right eye was 20/30; left eye, 20/50, with suppression.

On November 11, 1955, the patient was re-examined because his vision "seemed to be getting worse." On examination, his corrected vision was R.E., 20/40; L.E., 20/60, with suppression. Slitlamp examination showed neovascularization along the folds in Descemet's membrane in the right eye only. The vessels covered the entire posterior cornea, giving a blood vessel mosaic appearance along Descemet's folds. These folds were caused by cicatricial healing of the old corneal ulcer.

Investigation of the patient's history showed that he was on phenylbutazone for "rheumatic pains," 300 mg. daily after an initial dose of 600 mg. for two days. The patient had received this medication over a period of three weeks when the first visual

* Butazolidin®, the brand of phenylbutazone manufactured by Geigy Pharmaceuticals, New York.

symptoms appeared. One week elapsed before the eye examination, making a total of four weeks on phenylbutazone. The total dose over the four-week interval was 9.0 gm. He was ordered to discontinue phenylbutazone and given 30 mg. of riboflavin daily.

On November 22nd, 11 days after discontinuing phenylbutazone, the neovascularization had receded to the periphery of the cornea. There were only peripheral vascular loops several mm. from the limbus. Exactly one month after the new therapy was instituted, the corneal vascularization had disappeared completely. The patient was given a new refraction on January 19, 1956. The best corrected vision in the right eye is now 20/30+.

Conclusion

This patient was receiving phenylbutazone in doses well within the daily recommended dosage. He had no other physical complaints or apparent toxic signs.

Kuzell, et al.[2] reported that 14 patients complained of visual disturbance, which they variously described as blurring, flickering, or focusing difficulty. In all but one case the symptoms were transitory.

Visual symptoms may be due to water retention[2] which causes a corneal edema. This usually precedes corneal neovascularization.

Riboflavin was given as supportive therapy, since it is considered essential to biologic oxidation-reduction reactions necessary in corneal repair.

Summary

The present case showed reversible toxicity due to phenylbutazone which activated a latent asymptomatic corneal ulcer. Visual disturbances due to edema and neovascularization responded to discontinuation of the drug and supportive therapy.

719 Park Avenue.

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AN EYE TEMPLATE*

Maurice D. Pearlman, M.D.
Chicago, Illinois

This simple device is a flat, molded, clear plastic plate with various-shaped holes which enable the ophthalmologist to trace outlines of the eye or its component parts quickly and uniformly on any office, clinic, or hospital record. It should be useful to those who prefer labelled illustrations to extensive descriptions on their clinical records. In using this template, the need for special rubber stamps or printed forms is obviated; only a pencil or pen is necessary to trace outlines of

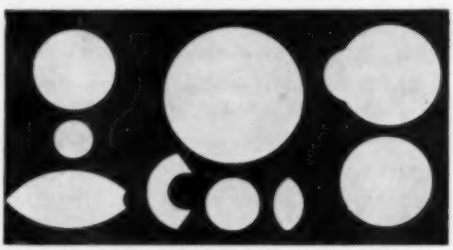

Fig. 1 (Pearlman). Eye template.

(a) palpebral fissure, lids, and caruncle; (b) frontal and lateral views of cornea; (c) frontal and lateral views of lens; (d) frontal and lateral views of globe; (e) fundus, including disc; (f) gonioscopic diagram of anterior chamber angle.

Two parallel millimeter scales are incor-

* Distributed by The House of Vision, Inc., 30 North Michigan Avenue, Chicago 2, Illinois.

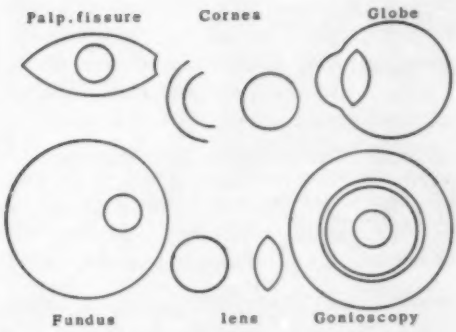

Fig. 2 (Pearlman). Traced outlines produced with the eye template.

porated on the long edges of the template to measure such things as lesions, pupils, palpebral fissures, and interpupillary distances, as well as for exophthalmometry. This last measurement is made by placing one of the specially notched corners against the lateral orbital rim (as is done with the Luedde exophthalmometer) and sighting obliquely for the reflected image of the corneal surface on the tops of the two scales to eliminate parallactic error. It is also designed to fit conveniently in a coat or shirt pocket.

55 East Washington Street (2).

MONOCULAR APHAKIA

In a seven-year-old: Corrected with contact glass

Jesse M. Levitt, M.D.
Brooklyn, New York

The advantages of correcting monocular aphakia with a contact glass have recently been elaborated by Constantine and McLean,[1] Gyorffy,[2] and Goar.[3] The amblyopia and exotropia which so frequently result from uncorrected aphakia despite successful operation for traumatic or congenital cataract are disheartening, especially in young patients. To avert these complications contact glasses should be tried; they may be surprisingly well tolerated, even by children, as in the following case.

Case report

S. G., a seven-year-old boy, was hit in the right eye with a stick on October 13, 1955. Examination showed erosion of the central cornea and blood in the anterior chamber. He was admitted to the Brooklyn Eye and Ear Hospital, and discharged on October 18th with a clouding crystalline lens as a sequela. The lens rapidly became opaque.

The child was rehospitalized on November 18, 1955, and a linear cataract extraction was performed. A clear central pupil resulted. The fundus was normal. At the end of January, 1956, vision of the operated eye with a plus-13D. sph. was 20/40; naked vision of the other eye was 20/20.

A casting was taken of the aphakic eye for a contact lens. In February a contact lens (Lacrilens) was fitted. Because of the age of the patient, the lens was made slightly larger in over-all diameter, to compensate for future growth of the eye.

Vision with the corrected contact lens was 20/30. The patient was easily taught to insert and remove the lens without assistance. For a week he wore the lens for two four-hour periods a day, and the following week for two six-hour periods a day. From then to the present he has worn the lens continuously, from arising to retiring, without complaint. His co-operation has been excellent throughout.

515 Ocean Avenue (26).

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OPHTHALMIC RESEARCH

EDITED BY FRANK W. NEWELL, M.D.

Abstracts of papers presented before the Western Section of the Association for Research in Ophthalmology, San Francisco, January 28 and 29, 1957.
JEROME W. BETTMAN, M.D., *Section Chairman*
A. RAY IRVINE, JR., M.D., *Section Secretary*

The aqueous: plasma steady-state ratios of potassium and sodium and the influence of Diamox and dibenamine thereon. John E. Harris, M.D., A. Eugene Carlson, M.D. Louise Gruber, B.S., and Gertrude Hoskinson, B.S., University of Oregon, Portland.

Published analyses of the aqueous humor generally have indicated that the aqueous humor: plasma steady-state ratios for the two cations, sodium and potassium, are essentially the same. A few years ago, while studying the hydration of the cornea, we observed that, in the rabbit, the steady-state ratio for potassium was significantly higher than that of sodium. The present paper is an extension of those studies.

Analyses have been performed on aqueous and arterial serum using a flame photometer. Thus, it has been possible to measure both sodium and potassium on one aqueous sample. Primary anterior chamber aqueous of the rabbit was utilized.

In the rabbit, the aqueous humor: serum steady-state ratio for potassium was found to be uniformally around 1.0, whereas that of sodium was less than 1.0. The ratio for potassium is clearly in excess of that predicted from the Donnan equilibrium. The difference was fairly marked and consistent. Administration of Diamox was followed by a depletion of potassium as has been suggested, since following Diamox there was a fairly marked decrease in the serum potassium. The aqueous: serum steady-state ratio for potassium, therefore, did not decrease. Little change in the sodium content of either the aqueous or serum was observed following a Diamox dosage of 50 mg. per kg. Dibenamine in doses of 20 mg. per kg. also produced a decrease in the potassium concentration of the aqueous and serum while little change in the sodium concentrations was observed. The changes were comparable to those observed following Diamox.

The results are discussed from two points of view: (a) that an anion is primarily secreted, the difference in steady-state ratios of the cations being due to a difference in mobility of the ions, and (b) that a cation, primarily potassium, is actively transported.

The influence of insulin on the glucose transport across the lens surface of normal and diabetic rabbits. Kenneth M. Giles, B.S., and John E. Harris, M.D., University of Oregon, Portland.

Evidence gathered in this and other laboratories has indicated that the movement of glucose into the lens is metabolically mediated and not dependent solely upon simple diffusion. If the lens were like many cells one would anticipate that such movement of glucose would be enhanced by insulin. We have been unable to demonstrate that insulin has any effect on the movement of glucose across the lens surfaces or on the utilization of glucose by the intact lens. However, Ross

found the utilization of glucose by decapsulated lenses to be markedly increased in the presence of insulin. We have been unable to confirm his findings.

The effect of insulin on glucose uptake by intact cells is generally best demonstrated in the diabetic animal. We have accordingly tested the effect of insulin on the glucose accumulation in normal rabbit lenses and those from rabbits made diabetic with alloxan. Glucose uniformly labelled with C^{14} was employed, the lenses being incubated at 37°C. in a modified Tyrode's solution. The uptake of radioactivity by the lens at various time intervals was measured.

The accumulation of radioactivity in the normal intact rabbit lens was found generally to follow the time course previously obtained when the accumulation of the reducing substance was measured, the steady-state being achieved in approximately 24 hours.

The uptake of radioactivity was the same in media of 200 mg. percent and 90 mg. percent glucose. The uptake of radioactivity from the lenses of alloxan-induced diabetic rabbits was substantially that of normal lenses. The addition of 0.1 unit per cc. of HGF-free crystalline insulin did not alter the rate of accumulation of the radioactive material in either the normal or alloxan-diabetic animal. It is concluded that insulin has no effect on the uptake of glucose by the lens.

The extraocular muscles and physiologic nystagmus. Frederick W. Hebbard, M.S., and Elwin Marg, Ph.D., University of California, Berkeley 4.

Physiologic nystagmus recorded using the "optical-lever" principle on cats prepared by the encéphale isolé technique is similar in appearance to that of man. The fine tremor in cats varies in frequency from 35 to 65 per sec., averaging 50 per sec., and in amplitude from four to 52 sec. of arc, averaging 22 sec. Small saccadic movements are also present, but they are smaller and fewer than the saccades found in man.

Physiologic nystagmus recorded from the inferior oblique muscle detached from the globe was much lower in amplitude and frequency than that of the intact eye. The physiologic nystagmus of the eye was not reduced after detaching the inferior oblique. Eye movements recorded after detaching all the extraocular muscles except the retractor bulbi and medial rectus still showed considerable physiologic nystagmus, including some small saccades. When the medial rectus was detached, some tremor remained, although saccades were not found. Retrobulbar injection of procaine abolished all physiologic nystagmus.

Intravenous injection of curare (*d*-tubocurarine) abolished all physiologic nystagmus in the intact eye, whereas neostigmine increased it.

The principal source of physiologic nystagmus in the horizontal direction in cats is thus in the horizontal rectus muscles. The retractor bulbi makes a lesser contribution, and the inferior oblique makes a negligible contribution in the horizontal direction.

Experimental ocular toxoplasmosis. Michael J. Hogan, M.D., Phyllis Zweigart and Ann Lewis, Francis I. Proctor Foundation for Research in Ophthalmology and Department of Ophthalmology, University of California School of Medicine, San Francisco 22.

Forty-five female guinea pigs with negative serum titers at 1:16 with the Sabin-Feldman dye test were given intravitreal inoculations in the right eye of approximately 5,000 Toxoplasma organisms. They were divided into five groups of nine animals each.

Group I was fed 2.5 mg. of sulfadiazine per kg. of body weight twice daily, starting the morning of the inoculation.

Group II was fed the same amount of sulfadiazine plus 0.4 mg. Daraprim, twice daily, starting the morning of the inoculation.

Group III was fed the same amount of sulfadiazine starting a week after inoculation. Group IV received the same amount of the combination of sulfadiazine and Daraprim, starting after a week. Group V were retained as untreated controls.

All the animals were fed a solution of the drugs by pipette early in the morning and late in the afternoon. They were medicated for five days, then not treated for two days, then medicated for five days more, a total of 10 days for each group.

All animals developed a definite chorioretinitis within three weeks.

Several died in each group, leaving six pigs in Groups I and II, seven in Groups II and IV, and five in Group V.

All remaining animals were killed at the end of three and one-half months.

The right choroid and retina and vitreous of each animal were ground in a mortar, and inoculated intraperitoneally into three mice. The brains also were ground and inoculated into mice.

Toxoplasma was recovered from all those mice which were inoculated with guinea pig brains.

Toxoplasma was isolated in mice from the eye tissues of the guinea pigs in all groups except three in Group II and one in Group IV.

Experimental hyphema in rabbits. Robert M. Sinskey, M.D., with the assistance of Alice Krichesky and Robert Henrickson, University of California, Los Angeles. This work was supported in part by a grant from the University of California, Los Angeles.

Although hyphema is not an uncommon complication of ocular trauma, either surgical or otherwise, very little basic research has been done in this field. This paper is concerned with whether red cells get out of the anterior chamber as whole red cells or are washed out in the hemolyzed state.

Red cells are tagged with relatively large amounts of P^{32}. One portion of the tagged red cells is hemolyzed. Using two groups of rabbits, whole tagged red cells are injected into the anterior chamber of one group and the hemolyzed cells with P^{32} are injected into the anterior chamber of the other group. After a three-hour period, whole blood is withdrawn from the hearts of the rabbits and separated into erythrocytes and plasma. The P^{32} is extracted from each component and counted.

In the rabbits injected with whole red cells, most of the blood remained in the anterior chamber at the end of the three hours. The rabbits with hemolyzed blood had very little left in the anterior chamber at the termination of the experiment. The plasma and cell counts on the peripheral blood of the hemolyzed group indicate that although large amounts of P^{32} must have washed into the peripheral blood, very little went into the red blood cells and most was washed out in the kidneys.

In the whole red cell-injected rabbits, although grossly less material got out of the anterior chamber, the cell count of the periperal blood was as high as 36 times that of the plasma, compared to a maximum of 1.9 to 1.0 in the hemolyzed group. These figures indicate that whole red cells can get out of the anterior chamber of the eye without undergoing hemolysis first and, apparently, get out relatively easily.

This technique with modifications is particularly adapted for measuring the effect of various drugs and the size of the pupils on the rate of absorption of hyphemas.

The effect of beef hemoglobin on rabbit vitreous. Catherine Squire, A. B., Sara

J. Karg, M.A., and W. K. McEwen, Ph.D., The Francis I. Proctor Foundation for Research in Ophthalmology, University of California Medical Center, San Francisco 22. This work was supported in part by Contract DA-49-007-MD-394 of the Department of the Army.

In previous work it was found that rabbit or beef whole blood when injected into a rabbit's eye causes partial liquefaction of the vitreous. Although there was deposit of pigment and, in some cases, the formation of strands, there was no apparent pathologic change. To date the "liquefying" property of whole blood has been traced to the hemoglobin fraction. Purification of the hemoglobin has been found to decrease both the occurrence of strands and the amount of pigment deposited.

The extent of the liquefaction of the vitreous is estimated from the amount of vitreous in gm. which drains through a 5.0-mm. square opening in five seconds. Liquefaction of a normal-sized rabbit eye varies from zero (no liquefaction) to one (complete liquefaction).

The hemoglobin fraction is prepared from washed, lysed beef red blood cells by salting out with ammonium sulfate between 50-percent and 70-percent saturation. The salt is removed by dialysis and the hemoglobin content is made roughly equivalent with that of the original blood.

Of 28 eyes which have been injected with 0.1 ml. of this fraction, four showed a liquefaction less than 0.6, 19 were greater than 0.6, and in five there was virtually complete liquefaction.

Structural changes in rabbit eyes induced by hyaluronic acid sulfate. John E. Harris, M.D., University of Oregon, Portland.

A hyaluronic acid sulfate has recently been prepared and made available for laboratory study. The compound has been found to have certain antihyaluronidase activity and this first aroused our interest. The current study is concerned with changes in gross structure in the eyes induced by the drug.

Three mg. of hyaluronic acid sulfate concentrated in 0.05 cc. of water were injected into the vitreous of living rabbits on each of two successive days. The eyes were observed with a biomicroscope and ophthalmoscope and periodically the animals were killed for gross and histologic examinations.

The first noticeable change was liquefaction of the vitreous, seen in two to four days. The degree of liquefaction was variable. The attachment of the vitreous to the lens and zonules was lost. By one to two weeks the zonules of the lens were weakened and were easily broken with a lens loop. In certain cases spontaneous dislocation of the lens occurred.

At varying time intervals from one to three weeks, opacities of the cornea developed. These were attributed to two processes. First, in certain instances the cornea became markedly hydrated. Second, subepithelial opacities not associated with the hydration were noted. Certain corneas showed a localized ectasia while in others the entire cornea increased in size. The anterior chamber became quite deep.

Six to 12 weeks after injection a cataract has been observed, the lens becoming markedly intumescent. Before development of the opacity, hydration of the lens has been measured. In certain specimens a neovascularization on the surface of the iris has also developed.

Through all these changes there was little or no inflammatory response. Some animals showed a slight beam but generally no cells in the aqueous. The eye was generally white although occasionally a circumcorneal injection occurred. The changes were not, therefore, a result

of inflammation. Rather, it is considered that they are due to a fundamental alteration and possibly replacement of the polysaccharide of the ground substance of ocular tissues. Less likely, the results can be interpreted as due to inhibition of hyaluronidase.

The effect of cyclotonia and cycloplegia on the histology of the trabecular meshwork of monkey eyes. Milton Flocks, M.D., and H. Christian Zweng, M.D., Stanford University School of Medicine, San Francisco.

Recent anatomic studies of tangential sections of the trabecular meshwork have demonstrated that the openings in the large corneoscleral portion of the trabecular meshwork are elliptical and oriented so that the long axes of the ellipses are circumferential. This circumferential direction is parallel to the scleral spur and perpendicular to the longitudinal fibers of the ciliary muscle which attach to the spur. It would appear from this arrangement that contraction of the ciliary muscle, as following pilocarpine administration, would make the openings rounder and therefore larger. A change in size of these openings would suggest that this may be one way in which cyclotonic drugs act to increase the facility of outflow in open-angle glaucoma.

Monkey eyes were used for the study because of the marked similarity of the trabecular meshwork of the animals to those of human eyes.

By the use of frequent applications of two-percent atropine to the right eye and two-percent pilocarpine to the left eye, marked mydriasis was produced in one eye and miosis in the other. The mydriatic eye was then enucleated.

By intraperitoneal injection of massive doses of pilocarpine, a state of generalized pilocarpine toxicity is produced which keeps the pupil from dilating at the time the miotic eye is being enucleated.

The meshworks of the enucleated eyes were studied in meridional and in serial tangential sections. The elliptical openings of the corneoscleral meshworks are rounder and larger in the miotic eyes. The trabecular lamellae, as seen in merdional sections, are farther apart in the miotic eyes. The position of the scleral spur changes when the ciliary muscle is contracted.

Melanomas of ciliary body. Robert E. Hopkins, M.D., and F. R. Carriker, M.D., Department of Ophthalmology, University of California School of Medicine, San Francisco.

This is a study of 25 eye specimens that were enucleated with the clinical and pathologic diagnosis of melanoma of the ciliary body. The clinical findings and symptoms in these cases were evaluated in order to facilitate earlier diagnosis in these cases. The study demonstrates the variable clinical-pathologic picture of melanomas of the ciliary body. In some cases there was extension into the angle which was evident gonioscopically. In others the tumor caused reabsorption and lens changes in the region of the tumor. The incidence of glaucoma with melanoma of the ciliary body was variable. The majority of the cases with melanoma of the ciliary body did have subjective symptoms related to the visual acuity. However, the visual disturbance was not usually related to loss of accommodation due to ciliary body damage. The pathologic sections were studied to correlate the pathologic changes with the clinical findings. The tumors were classified according to the Callender classification and compared with the melanomas of the choroid.

The relative volume of blood in the choroid and retina. Peter Chao, M.D., and J. W. Bettman, M. D., Division of Surgery, Department of Ophthalmol-

ogy, Stanford University School of Medicine, San Francisco. This study was supported in part by USPH grant No. 91299-3.

It is now possible to measure changes in the total blood volume of the choroid and retina by the use of radioactive phosphorus (P^{32}). The technique for this procedure has been reported previously (Am. J. Ophth., **42**:161 [Oct., Pt. II] 1956). Using this method the effect of drugs and other agents capable of altering the blood volume has been evaluated (Tr. Am. Acad. Ophth., in press).

It is important to know what proportion of this total blood volume is in the retinal vascular system and what proportion is choroidal. It is the purpose of this investigation to determine this by the use of Neoprene injections, as suggested by A. E. Maumenee, M.D.

This technique is:

The heparinized, anesthetized cat was decapitated. The remaining blood was washed out of the head by perfusion of ammonia water through the carotid artery for 30 minutes.

Neoprene was injected through both carotid arteries simultaneously, with moderate pressure, until the eyeballs were hard by palpation. The free venous return of Neoprene was prevented by tying the animal's neck with string.

The eyes were enucleated, fixed in four-percent acetic acid for two hours to solidify the Neoprene, and then fixed in four-percent formaldehyde for 24 hours.

The retina and choroid were dissected out and placed in separate containers. The tissue was then entirely digested in pepsin in 0.1 N hydrochloric acid solution in an incubator at 37°C. for 48 hours.

The Neoprene casts were removed, treated with one-percent oxalic acid and two-percent potassium oxalate to decrease the stickiness, dried and weighed.

This technique was used in four cats. The relative blood volume of the choroid to the retina was found to be 37 to 1.

This would suggest that measurements of changes in the total blood volume of the retina and choroid reflect the choroidal blood volume almost entirely.

Albumins and a tear beta in lacrimal protein patterns. Olive Fedde Erickson, M.D. Stanford University School of Medicine, San Francisco.

It was the purpose of this study to explore the presence or absence of tear albumin and tear beta in normal and abnormal tear electrophoresis scans.

The lacrimal specimen is collected by placing a bent indicator filter paper under the lower lid of the eye until the paper is moistened, but not for more than five minutes. This moist Schirmer test paper is preserved in Saran Wrap until electrophoresis is started, using the hanging strip technique with a Durrum cell unit. A phosphate buffer at a pH of 7.0, an ionic strength of 0.2 and a power unit set at 40 ma. has proved to give the most successful patterns in our hands.

After the electrophoresis strips have been saturated with a phosphate buffer, the Schirmer paper, still moist with the lacrimal secretions, is removed from the Saran Wrap and placed on the electrophoresis strip between the two rods toward the positive pole. After the indicator moves off the original Schirmer papers, they are removed and the power unit is allowed to run its completion in seven hours. The indicator moves with the serum albumin and the lysozyme moves in the opposite direction to the negative pole. After a strip has been dyed, it is threaded into the analytrol where the separated proteins are directly evaluated with the recording scanner and integrator in the same manner as serum proteins.

With the aid of a flannel graph board, the three, peaked, normal lacrimal protein patterns were shown. It was pointed out that the albumin in the normal tear

patterns has a faster mobility than serum albumin. In the normal human lacrimal protein pattern the proteins are distributed approximately 30-percent lysozyme, 40 percent in the mobility range of serum globulins, and 30-percent albumins of which at least half should probably be "tear albumin." There is a protein with the same mobility as beta globulin in serum which forms the center peak in a normal lacrimal protein pattern which is absent after surgical removal and Sjøgren's syndrome.

Experimental exophthalmos. Robert Brunish, Ph.D., Department of Physiological Chemistry, School of Medicine, University of California, Los Angeles.

The exophthalmic activity of thyrotrophic hormone preparations (TSH) was investigated. The fish, *Fundulus parvipinnis,* was employed to assay exophthalmic activity. Increase in intercorneal distance following interperitoneal injection of the test material served as a measure of activity.

TSH was prepared using the method of Ciereszko (J. Biol. Chem., **160**:585, 1945). The water-soluble extract of Ciereszko's CA precipitate served as starting material, having both exophthalmic and thyrotrophic activity. It was then possible to remove most of the TSH activity without affecting the exophthalmic potency. The material at this stage was electrophoretically heterogeneous.

A time study was undertaken to investigate the chemical changes induced in the fish orbit under the influence of the preparation described. Concomitant with exophthalmos there was an increase in water and hexosamine content in the tissues lying behind the globe.

Parallel experiments were undertaken in the guinea pig.

Pilocarpine stability studies. Sidney Riegelman, Ph.D., School of Pharmacy, and Daniel G. Vaughan, Jr., M.D., Department of Ophthalmology, University of California School of Medicine, San Francisco 22.

Pilocarpine is the commonest antiglaucoma drug, yet a minimum of information is available concerning its stability at different pH and temperature levels.

Previous work published in the chemical literature indicates that pilocarpine, under certain conditions, converts to isopilocarpine, which is therapeutically less active. No visible change is noted. This conversion can be detected and measured by the change in optical rotation.

Our experimental data indicates that pilocarpine is markedly stabilized by reducing the pH of the ophthalmic vehicle.

Association of pleuropneumonialike organisms with conjunctivitis of cats. Robert M. Cello, D.V.M. School of Veterinary Medicine, Davis, California, and Francis I. Proctor Foundation for Research in Ophthalmology, University of California, San Francisco.

This study is a preliminary report on the possible relationship of pleuropneumonialike organisms to an infectious conjunctivitis of cats. Three mature Siamese cats were seen and each of these showed a unilateral purulent ocular discharge, with hyperemia and chemosis of the bulbar and palpebral conjunctiva. A white membrane, which peeled with some difficulty, was present on the conjunctiva of the lower lid and the anterior surface of the nictitating membrane. The corneas were clear and there were no signs of systemic disease. In all cases the second eye became infected approximately two weeks after the initial signs were noticed.

Bacteriologic culture of smears on standard media showed micrococci and streptococci. Scrapings from the conjunctiva showed many neutrophils, some mononuclear cells, and rare micrococci. Giemsa-strained preparations showed mi-

nute blue-staining intracytoplasmic inclusion bodies in many of the epithelial cells. These varied in number and distribution from cell to cell and could be found in tightly packed clumps or as widely separated, evenly spaced coccoid or coccobacillary forms spread over the surface of most of the cells. They closely resembled the inclusions produced by rickettsia conjunctivae in sheep and pigs, and those found in mouse conjunctivitis caused by pleuropneumonialike organisms. Inclusions were found only in infected eyes during the time that ocular signs were present.

Typical colonies of pleuropneumonialike organisms developed 24 to 48 hours after inoculation of 10-percent horse-serum agar plates containing 1:4,000 thallium acetate with conjunctival washings. These were very rough, 50 to 75 microns in diameter, and stained preparations showed only coccoid forms of the organism. The organism could be maintained in horse-serum enriched broth for 24 to 48 hours but did not grow in this medium. These organisms were found only in infected eyes which showed cytoplasmic inclusions.

Infected washings did not produce an infection when they were rubbed into the conjunctivas of three normal cats. In six eyes which were treated with a subconjunctival injection of hydrocortisone at the time of inoculation, an infection identical to that seen in the natural cases developed. Ocular signs were noticed after seven days and were quite severe in 10 days. The opposite eye which was used as a control remained normal until the 15th or 16th day following inoculation, at which time it developed a conjunctivitis indistinguishable from that of its fellow.

In one untreated cat, ocular signs were present for 34 days. Topical application of penicillin and bacitracin did not alter the course of the disease, but marked improvement occurred within five days in eyes which were treated with Chloromycetin or erythromycin.

Cytoplasmic inclusions were found in conjunctival scrapings of all infected eyes, and pleuropneumonialike organisms were found in the only two eyes cultured. Negative results were obtained when washings from infected eyes were inoculated in HeLa cells, or chick embryos. Attempts to produce the condition with pleuropneumonialike organism broth cultures were unsuccessful.

The results of this study suggest that pleuropneumonialike organisms may play a part in the etiology of this condition. Future studies are planned to explore this relationship more thoroughly, and to compare this infection with the conjunctivitis in other species in which similar type inclusions can be found.

Toxoplasmosis: Selected experiments. Melvin L. Rubin, B.S. These experiments were performed at and with the co-operation of the Francis I. Proctor Foundation for Research in Ophthalmology, University of California, San Francisco, and were conducted under grants from summer fellowships: (1) U. S. Public Health Service, 1955, (2) National Council for the Prevention of Blindness, 1956.

I. *Toxoplasma—methylene blue dye test variation.* Five serum samples from 20 subjects were tested for dye test titer, the samples being drawn over a period of 16 days. This was repeated in another 20 subjects, each of whom was given one skin-test dose of Toxoplasma antigen before beginning the serum withdrawal series.

In both series the dye test titers remained remarkably constant for each individual, and did not change after the preceding injection of Toxoplasma antigen. This work also established the repeatability of the serologic dye test determination.

II. *Skin test response in guinea pigs infected with toxoplasmosis.* After infection

with an approximate $L.D._{50}$ dose of Toxoplasma (RH strain), guinea pigs did not develop a skin test reaction to Toxoplasma antigen. There was no positive reaction after 17 months of chronic infection.

III. *Chemotherapy of toxoplasmosis.* Several antimalarial drugs were tested for effectiveness in prolonging the life of mice after infection with a highly lethal dose of Toxoplasma (RH strain). Oral or subcutaneous drug administrations were employed. None of these (Plaquenil, Aralen, and Primaquine) showed any effect.

Various sulfa compounds, both alone and in combination with pyrimethamine, were tested as drug cures. The most effective combinations were sulfapyrazine-pyrimethamine, and sulfadiazine-pyrimethamine mixtures, substantiating Eyles and others' work. Another double sulfa mixture (sulfamylon and sulfamerazine) was tested and also found to be very effective as a drug cure in acute toxoplasmosis especially when used with pyrimethamine. These experiments also demonstrated the synergism existing between certain sulfas and pyrimethamine against toxoplasmosis in mice.

IV. *Oral transmission of Toxoplasma.* Oral transmission of toxoplasmosis (via contaminated feces and contaminated food) was demonstrated in four out of four laboratory mice.

Miotic iridocyclitis. Samuel V. Abraham, M.D., Los Angeles, California.

The term, miotic iridocyclitis, or miotic uveitis, in my opinion, is truly descriptive of the condition frequently found in glaucomatous eyes under prolonged miotic therapy. That the use of miotics is the major cause of these changes and that these changes are not peculiar to glaucoma is indicated by the production of cysts in young normal eyes after using miotics a relatively short time. Cases and the literature are used to demonstrate this thought.

It seems, therefore, important to consider the danger of using miotics prophylactically in cases giving so-called positive provocative tests. It is also important to re-evaluate periodically the use of miotics even in cases of clinically proven glaucoma. A few cases are presented to emphasize this point.

Cases of glaucoma are presented which suggest that there may be many cases seemingly not controlled by miotics which may show a drop in tension when the miotics are discontinued entirely or materially reduced in strength or frequency of use.

And finally, the question is asked: Is it good surgical practice to operate on eyes with iritis—even with chemical iritis produced by miotics? An attempt with cases is made to answer this question in a way that suggests possible improvement in the results of glaucoma surgery.

Cytology of epithelial scrapings in herpes-simplex virus keratitis. P. Thygeson, M.D., and S. J. Kimura, M.D., Department of Ophthalmology and the Francis I. Proctor Foundation for Research in Ophthalmology, University of California School of Medicine, San Francisco 22.

Epithelial scrapings from herpetic vesicles of the skin have been shown by Blank et al. (J.A.M.A., **146**:1410, 1951) to contain viral type giant cells, sometimes measuring more than 50 microns in diameter and containing from two to 15 or more nuclei. They found them only in scrapings from vesicles of herpes simplex, varicella, and herpes zoster. Since in the cornea neither zoster nor varicella are to be confused with herpes simplex, the findings of such giant cells in scrapings from a questionable keratitis should indicate herpes simplex infection.

In a previous study (Arch. Ophth., **56**: 375, 1946) we reported the finding of such cells in scrapings from dendritic keratitis. The present report is an amplification and extension of this earlier work.

We have studied corneal scrapings from 50 cases of herpetic keratitis and have found these giant cells regularly in scrapings from deep forms. We have not found these cells

in corneal scrapings from other superficial ulcers, including catarrhal ulcers and recurrent erosions. We have been unable to demonstrate intranuclear inclusions in herpetic scrapings. No characteristic leukocytic formula has been noted in such scrapings, and the presence of neutrophils has not been found to indicate secondary bacterial or fungal infection, as it generally does in conjunctival scrapings.

A study of flat preparations of the choriocapillaris. Frank C. Winter, M.D., Menlo Park, California, Stanford University School of Medicine, San Francisco.

A method similar to that described by M. Saltzman in 1912 has been used for the preparation of specimens of the choriocapillaris of humans and animals for staining by various techniques and microscopic study. The choroid is removed in toto from fixed eyes. It is incised radially and laid out inner side up. The adherent retinal pigment epithelium is removed by gently rubbing with the finger. The tissue is transferred to saline and placed in a Petri dish outer side up. The larger vessels such as the vortex veins are grasped with fine, blunt forceps and gently pulled away carrying with them many of the larger and intermediate vessels of the choroid. In this manner large areas of the choroid can be reduced to a layer consisting only of the choriocapillaris and adherent Bruch's membrane. This tissue is bleached with potassium permanganate, dehydrated, and fixed to glass slides with albumin for staining by various techniques. It is felt that the technique will prove valuable in the investigation of the pathology of certain vascular diseases of the choroid.

Thermal effects within ocular tissues during retinopexy procedures. Henry A. Knoll, Ph.D., Department of Biophysics, University of California Medical Center, Los Angeles.

The term retinopexy here is taken to mean the use of high frequency current applied to the sclera to induce scleral and choroidal heating as a method of inducing an exudative choroiditis with the subsequent effect of establishing a firm adhesion between choroid and a detached retina. It has been the aim of this study to establish the thermal gradient which exists in the ocular tissues surrounding the treating needle.

The thermal recording was done by means of an iron-constantan thermocouple connected to a continuous balance Wheatstone bridge circuit and a Brown strip recorder. This arrangement permitted continuous recording of temperatures at a given site represented by the location of the implanted thermocouple.

It was not possible to record temperatures within two mm. of the needle, since these short distances resulted in sparking between the treating electrode and the thermocouple. Maximum temperatures of 45°C to 50°C have been recorded in the sclera. Much smaller temperatures, representing only slight elevations above body temperature, have been recorded in the vitreous at comparable distances from the treating needle. Following treatment the temperature returns to the baseline within 30 seconds.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

YALE UNIVERSITY CLINICAL CONFERENCE

January 13, 1956

DR. R. M. FASANELLA, *presiding*

OCULAR RADIATION THERAPY

DR. MERRIAM noted that radiation has been used for therapy for approximately 40 years. Recently ophthalmologists have become more interested in superficial beta radiation. Therapy is limited by the effects of the radiation on the tissues of the normal eye. The use of Grenz rays of five to 15 kv. was mentioned. This is a soft type of long-wave radiation and has been used up to 8,000 r. On the conjunctiva, the only effect is that of telangiectasis. Pigmentation effects on the skin limit its use in that way.

The following harmful late effects have been noted with the following dosage in rep.:

1. *On the conjunctiva:* (a) telangiectasis with 3,000 to 5,000 rep.; (b) keratinization of epithelium with 5,000 to 10,000 rep.

2. *Sclera:* (a) atrophy with 20,000 to 30,000 rep.

3. *Cornea:* (a) superficial punctuate keratitis with about 5,000 rep.; (b) vascularization with 20,000 to 30,000 rep.; (c) scarring with 25,000 rep.

4. *Iris:* (a) iritis with 22,000 to 27,000 rep.; (b) iris atrophy with 20,000 to 30,000 rep.

5. *Lens:* (a) radiation cataract with 2,300 to 32,000 rep.

The effects of more penetrating radiation on the tissues are:

1. *Lids:* skin atrophy, increased pigmentation, telangiectasis, atrophy, and fibrosis of subepithelial tissues.

2. *Cornea:* punctate keratitis, edema, keratinization, thinning, scarring, and vascularization.

3. *Radiation cataract:* A dosage of 500 r at the lens results in about 50 percent cataracts developing; 1,000 r at the lens gives 100-percent development of cataracts (in doses fractionated over a period of three months). A single dose of 200 r at the lens may give cataract formation.

4. *Retina:* may show edema, vascular changes, sheathing, neovascularization, white deposits, hemorrhage scarring, detachment, hemorrhagic glaucoma.

In general, the following were Dr. Merriam's indications for radiotherapy. First, in regard to superficial radiation, that is, Grenz and beta radiation:

1. *Vernal catarrh* which he found quite radioresistant. A few cases were treated and a maximum of 5,000 r was used.

2. *Corneal vascularization.* There was no uniformity of response and it was noted in control cases that often the cornea tends to free itself of vessels over a long period of time.

3. *Corneal ulcers* occasionally respond very well. A total of 5,000 r was given in divided doses over a three-month period using Grenz rays.

4. *Lid tumors:* (a) small hemangiomas, 90 percent of these need no treatment at all; (b) papillomas are easily treated by surgery or cauterization; (c) granulomas following chalazion operations are better treated by surgery or cauterization; (d) precancerous melanosis of the conjunctiva, diagnosis made by biopsy. A total of 7,000 r at 15 kv. was given over a period of several weeks. It is now known that from 3,000 to 5,000 r would be enough.

5. *Recurrent pterygia.* Large recurrences should be re-excised and then radiation started one or two days postoperatively using a total of 3,000 r.

6. *Nodular episcleritis,* if resistant to all other therapy, may respond very well. A total of 500 r can be used for three doses, giving

a total of 1,500 r. This was done with a 15 kv. Grenz rays, once weekly.

7. *Phlyctenular keratitis* if resistant to other therapy. Here Grenz rays have had somewhat of an analgesic effect.

8. *Bullous keratitis* and filamentary keratitis. The patients seemed to feel better, although the corneal appearance was the same, and half of these responded to 500 r twice a week for four doses.

9. *Resistant corneal ulcers* also demonstrated an analgesic effect and were given a total of 1500 r in three doses over a period of one and one-half weeks.

Dr. Merriam next discussed the indications for low-voltage therapy, that is, 100 kv. X rays:

1. *Epithelial downgrowth* into the anterior chamber. He noted that the diagnosis was difficult and that a biopsy of the iris was the only real way of a definitive diagnosis. About 20 percent of the cases responded favorably. Dr. Merriam noted that the more extensive the corneal edema, the less favorable the case. These were treated with 500 r twice a week to a total of 7,000 r. One should treat a larger area of the cornea than is apparently involved. At the present time, he feels that you should not exceed 5,000 r therapy and that often 3,000 r will be enough.

2. *Cysts* of the anterior chamber are better treated by diathermy.

3. *Basal-cell carcinoma* of the lids. Five year results are about the same as with surgery. The older the patient and the more extensive the lesion, the more suitable for radiation.

4. *Squamous-cell carcinoma* can be treated, but in high doses.

The next topic was the indication for high-voltage therapy of 200 to 250 kv.

1. *Retinoblastoma.* In unilateral cases, enucleation is indicated. In bilateral cases he felt that the worse eye should be enucleated and the better eye irradiated. Special cones were used to shield the anterior segment of the eye and 400 r were given three times a week up to a total of 4,000 r in each of two portals. The results showed that two thirds of the cases survived and half of the survivors had useful vision. Some late hemorrhages in the retina were noted in earlier cases treated with higher doses up to 1,200 r. At the present time, a combination of X rays and triethylene melamine (total of 15 mg.) is being used. Residual disease of the optic nerve does not seem to respond to any form of treatment.

2. *Lymphosarcoma* of the orbit, lids, conjunctiva, lacrimal gland, and so forth has a survival rate of about 52 percent when the disease is localized, that is, in cases in which lesions are solely in the head and neck. In an ocular lymphosarcoma with no generalized disease for five years, the prognosis is good.

3. *Hemangiomas.* About 99 percent of the small ones disappear without treatment, or may be treated with sclerosing solution.

4. *Metastatic carcinoma* to the eye has been treated with a total of 4,000 r in divided doses of 500 r twice a week and has been found useful where one seeing eye is involved.

Miscellaneous conditions treated include Eales' disease and diabetic retinopathy in which the responses were negative. All treatment in these types of cases have been discontinued. Mixed tumors of the lacrimal gland are best treated by surgery and the recurrences if any can be treated by radiation.

Discussion. Dr. Jansen: Have you had any experience with treatment of (1) severe edema following surgery for thyrotoxicosis, and (2) chronic granuloma or pseudotumor of the orbit?

Dr. Merriam: We are treating a series of such cases, orbital granuloma, thyrotropic exophthalmos, pseudotumor, but so far we don't seem to have any better effect than the untreated eyes.

Dr. Wies: I have used beta application in the office with sporadic results. Occasionally I have treated a pinguecula with not very good results.

Dr. DeSuto-Nagy: In the early days of

treatment with Grenz rays, I was fortunate to have a considerable amount of experience in animal eyes and in a clinical series of over 700 cases that I treated at the University of Vienna under Professor Meller. A basic principle we noted at that time was that in radiation therapy of inflammatory external diseases of the eye, an optimal dosage is of the utmost importance. An overdosage will accentuate rather than ameliorate the inflammatory response. We found the effective anti-inflammatory dosage to be between 50 to 200 r. The optimal dosage depends on the acuteness or chronicity of the condition and also whether the inflammatory response was superficial or in the deep tissues. Such dosage, even if repeated, proved effective for the destruction of the inflammatory cells without damaging the corneal epithelium or stroma. Dr. Merriam is using 500 to 1,500 r regularly and repeatedly. I think this is too high a dosage. It may account for a disappointing result in some of his cases.

Dr. Chang: From the recent reports from Japanese survivors of the atomic explosion, who show marked epilation (200 to 300 r level) the effects noted have been polychromatic plaques in the posterior subcapsular area of the lens with no significant loss of vision. I, therefore, feel that below 300 r instantaneous dose, is a fairly safe level. We have had no experience here with Grenz rays. One case of diabetic retinitis proliferans had a good temporary result but the later results were very poor.

Dr. Clarke: Why omit surgery from the treatment of hemangioma? Continued closure of the eye in a severe case may lead to strabismus. I believe partial removal may be of help at an early stage.

Dr. Merriam: In cases with very large hemangiomas, surgery is very difficult and extensive unless the process is localized.

Dr. Freeman: How do you explain the effect on the corneal ulcer?

Dr. Merriam: I don't know. Ulcers with vascularization showed subsidence of the vessels, with healing of the ulcers. Some of these cases are now treated chiefly for the analgesic effect.

William I. Glass,
Recording Secretary.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 6, 1956

Dr. Bernard Kronenberg, *president*

Peripheral iridectomy

Dr. Eleanor Faye and Dr. Daniel Doctor reported a case of an elderly unreliable man with long-standing narrow-angle glaucoma with no history of acute congestive attacks. He was essentially a one-eyed man, with poor vision which could be accounted for by the contracted field and fixation defect, rather than by lens changes. Surgery had to be done as an alternative to unsuccessful medical management because of the unreliability of the patient and because the other eye had been lost from neglect of the same process. The patient had had a fair response to miotics so that it could be concluded that some of the angle was functioning. A peripheral iridectomy was done as the minimal surgical procedure with the least hazard to the eye. It was felt that any other procedure would involve greater trauma at the time of surgery, with loss of his remaining vision and with greater risk of postoperative complications.

Discussion. Dr. Kestenbaum asked why a total iridectomy had not been done so that, if later on a cataract extraction was necessary, it would be easier to do a second operation.

Dr. Doctor said that in this particular case a total iridectomy would probably have been just as effective but it was felt that peripheral iridectomy was a less drastic procedure and would produce less trauma to the eye.

Dr. Abraham Schlossman pointed out

that, since the patient, an elderly man, had cataractous changes in his only eye with vision and suffered from long-standing glaucoma with marked loss of field, a minimal surgical procedure would be advisable. Peripheral iridectomy is ordinarily not performed in the late stage of narrow-angle glaucoma but the reduced tension in this case demonstrates that it can occasionally be of benefit.

Leiomyoma of iris

Dr. Alvin Fisher said the importance of a leiomyoma is stressed in the differential diagnosis of iris tumors. A clinical description of a typical case was given. An iridectomy was performed so that all the visible tumor area was removed. The specimen was examined by Dr. De Veer and by the Armed Forces Institute of Pathology. He concurred in the diagnosis of a leiomyoma. The pathology of leiomyoma was discussed. It was stressed that, if this tumor is suspected and biopsy confirms it, total excision of the iris lesion suffices and needless sacrifice of visually efficient eyes can be avoided.

Neurilemoma of orbit

Dr. John T. Simonton reported the case of a 54-year-old woman whose only complaint was that her right eyeball seemed to be going up into her head. She did not complain of double vision. In 1918, she had sleeping sickness which left her with a weakness of her right arm and the usual lack of facial expression.

Corrected vision was: O.D., 20/25; O.S., 20/20. A firm mass was palpated in the temporal inferior half of the right orbit. The skin moved freely over the mass and did not seem to be frozen to the floor of the orbit. Exophthalmometer readings were: O.D., 24; O.S., 18. Central and peripheral fields of vision were normal. Media were clear and fundi negative. X-ray examination revealed a mass in the right antrum but the orbits appeared clear.

The right orbit was explored under general anesthesia via a transconjunctival approach and the mass was found to be localized and was easily excised. Microscopic examination showed the typical picture of neurilemoma.

Nine months after operation the proptosis of the right eye had entirely disappeared, the vision of each eye was correctible to 20/20, and a diplopia could be elicited only in gaze to the right and up. X-ray examination revealed the same type of mass in the right antrum.

Discussion. Dr. Benjamin Friedman asked if Dr. Simonton could explain the presence of the shadow in the antrum and did it appear in relationship to the tumor. Dr. Simonton said that, before the operation, the X-ray consultant and the Ear and Throat consultant and he were not certain if this tumor was localized to the orbit or if it was coming primarily from the antrum. However, upon exploring the orbit, the encapsulated tumor was easily removed in toto and follow-up X-ray examination showed the same mass in the antrum. Subsequently, consultation with Dr. Schwartz of the X-ray Department of the New York Eye and Ear Infirmary led to the opinion that this shadow in the antrum was undoubtedly due to a polyp. However, he was unable to say definitely because the patient declined any exploration of the antrum.

Dr. Alfred Kestenbaum asked if Dr. Simonton had any idea from which nerve this tumor could originate. Dr. Simonton replied that this tumor could originate from any of the nerves in the orbit. However, on careful examination of the eye and lids postoperatively, it could not be determined from which nerve the tumor did arise.

Congenital entropion

Dr. Sidney A. Fox presented two cases of congenital entropion seen in two female siblings, one aged two years and eight months and the other one year and eight months. The cause was hypertrophy of the marginal portion of the orbicularis muscle. He stated that only 15 such cases had previously been

reported, only one of which involved the upper lids. All the other cases involved both lower lids except one which was unilateral. The latter was due to hypertrophy of the tarsus caused by an accessory row of meibomian glands. Of the remaining 14 cases, nine were due to hypertrophy of the marginal portion of the orbicularis and five to absence of the tarsus.

Congenital entropion must be differentiated from epiblepharon which is a developmental anomaly characterized by the presence of a fold of skin running horizontally across the upper or lower lid. This accessory fold pushes the lashes against the globe and may give symptoms identical to those of congenital entropion. However, the lid margin remains in normal position and does not turn in, as in congenital entropion.

Repair of congenital entropion simply consists of the resection of a horizontal strip of skin and muscle according to the Celsus technique.

Discussion. Dr. M. H. Cohen asked how he was able to differentiate between hypertrophy and spasm in this child. Dr. Fox replied that, when there is spasm, it implies that the muscle is not in spasm sometimes and is in spasm at other times. This was a constant inversion of the lid; there was no apparent cause for the spasm of the lid. When the child was under anesthesia, a thick heavy band of muscle fibers was found, which looked like hypertrophy.

Dr. Bernard Kronenberg asked why this patient was not corrected bilaterally rather than one eye at a time.

Dr. Fox replied that he did the lids one at a time because the mother insisted that she could not take care of the child with both eyes patched at once. It would have been simpler for us to do both eyes at one time.

Dr. Jesse M. Levitt illustrated by slide a case of epiblepharon with inversion of the lashes which may be mistaken for a real congenital entropion. Dr. Fox remarked it was usually not necessary to operate in epiblepharon, as in the majority of cases the anomaly disappears spontaneously. If it persists three or four years, the skin only should be resected.

Bilateral uveitis, papillitis, and poliosis

Dr. Melvin Bronstein reported a case of Vogt-Koyanagi-Harada's disease. Headaches, nausea, vomiting, and bilateral edema of the optic nerveheads were the initial complaints. A ventriculogram was performed on the basis of progressive signs, with suspicion of an expanding intracranial lesion. There were no abnormal findings. The postoperative course was marred by a bacterial meningitis, successfully treated with antibiotics.

Five weeks after the onset of symptoms, a severe anterior uveitis was first noticed. The uveitis was suppressed with oral prednisone. When the dosage of steroid was reduced to a lower level, there was an exacerbation of the uveitis. The dosage of prednisone was increased and was maintained over a six-month period, during which time the uveitis was satisfactorily controlled.

Alopecia and poliosis were noted in the fifth month of the disease. There were no serious complications during the course of the uveitis. Vision was normal. It was suggested that the uveal reaction in Vogt-Koyanagi-Harada's disease responds to steroid therapy. Treatment should be maintained over a prolonged period.

Discussion. Dr. Isadore Givner said that it is interesting that the patient is a light-skinned individual, since most of the reported cases of Harada's disease were in either Japanese, Italian, or other deeply pigmented patients. Cutaneous pigment tests give a reaction similar to that found in sympathetic ophthalmia in one third of the cases.

Crawford (Hawaii M. J. **13**:26 [Sept.-Oct.] 1953) has suggested we call the syndrome "diffuse melanitis." He believes the disease involves the pigment-bearing tissues. There is melanin in the uveal tract and the

disease is most intense in the eye. There is melanin in the skin and hair. This accounts for the vitiligo and poliosis. A disturbance of the pigment granules in the cells of Hansen in the organ of Corti could explain the deafness. Melanoblasts are found in the pia mater of the ventral surface of the medulla oblongata. The presence of meningismus with an increased cell count in the spinal fluid could be the result of involvement of this tissue in the opinion of Crawford.

Dr. Samuel Gartner commented that he followed from its beginning this very interesting case. It had many puzzling aspects at each stage. Every case of uveitis is puzzling until its etiology is known. However, we usually have to be content with a clinical classification. This case fits into the group of Vogt-Koyanagi and Harada's diseases which can safely be lumped together.

Steroid therapy was helpful in this case but it had to be pushed to the limit of tolerance. After many months of steroid therapy, this patient definitely improved.

These cases are not clearly understood. Extensive studies for the cause were made. This included bacterial and virus studies which were not helpful. A virus etiology is suspected in these cases.

The resemblance of this group of diseases to sympathetic ophthalmia is of some interest. In both diseases a bilateral uveitis is present, and often poliosis. Some cases that are diagnosed clinically as sympathetic ophthalmia may belong to the group of Vogt-Koyanagi-Harada. The history of injury that patients describe is often given with any disease and may be misleading. Bilateral uveitis does not always mean sympathetic ophthalmia.

Dermoid cyst of lacrimal fossa

Dr. Victor Goodside reported the case of a three-year-old girl who presented a firm, rounded mass in the upper inner angle of the right orbit, first noted one week before. The mass was the size of a large pea, was not movable, but the skin could be freely moved over it. It was readily shelled out under general anesthesia and proved to be a dermoid cyst filling the entire lacrimal fossa from the dome down to the opening and into the nasolacrimal canal. The impression was that the cyst had displaced the lacrimal sac downward. The subsequent course was without event. The child continues to present no lacrimation or epiphora.

Justification for this report is that no similarly located dermoid cyst could be found in the literature. The present case did not differ histologically from the usual picture of a cyst wall composed of a connective tissue outer layer and an inner epithelial layer associated with sebaceous glands and hair follicles, the cavity being filled with sebaceous material. In addition, a portion of the wall consisted of granulation tissue, a feature to which Samuels has called particular attention.

Jesse M. Levitt,
Recording Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

December 15, 1955

Dr. Edmund B. Spaeth, *chairman*

Excision of localized iris tumor

Dr. Wilfred E. Fry: In the left eye, there was an elevated, pigmented lesion in the lower nasal angle of the eye. This measured approximately 2.0 by 3.0 mm. and appeared to extend into the angle by ordinary observation. The pupil was round and showed no evidence of distortion and reacted normally. In the fundus of this eye, the lens, vitreous, and other structures were entirely negative. There was no evidence of pressure on the periphery of the lens with a dilated pupil.

The following operative procedure was carried out. A fornix-based conjunctival flap was made extending from the 4- to 10-o'clock

positions. An incision was made through the sclera approximately two mm. behind the visible limbus and was carried straight down through the sclera by means of a Bard-Parker knife. The eye was penetrated at one point by means of the knife and the incision was enlarged by scissors. A suture was placed on the corneal side of the incision and by means of this the cornea could be raised. The iris could be inspected under direct vision.

By means of an iris forceps, the iris was picked up at one side of the tumor, a radial incision was made, the iris was stripped from the ciliary body to a point beyond the tumor on the opposite side and a second radial incision was made. The incision was closed by two silk sutures and the conjunctival flap was replaced. There were no complications as far as the postoperative recovery was concerned. The pathologic report of the tumor was a malignant melanoma.

Discussion. DR. CONWAY: I recall this case because it was very interesting when we performed the P^{32} test. As you recall the first uptake was recorded as 11 percent in 24 hours, and the second uptake was reported as 22 percent. According to the criteria of Eisenberg, the first-hour uptake of any suspected malignant lesion, or any lesion in the eye of less than 30 percent, is to be considered a nonmalignant lesion if the count is less than 30 percent in any case. However, if the count is more than 30 percent in the first hour of any suspected lesion, then the 24-hour count is indicated. If the count which is 30 percent rises to a higher count, then the lesion is to be considered malignant. If, however, the count falls from the original figure, the lesion is usually considered to be inflammatory in nature.

Now the clinical appearance of this growth at the time when the P^{32} was performed, prompted us to do a 24-hour uptake despite the fact that the initial first-hour count was only 11 percent. To my chagrin, I found that the count had risen to 48 percent. I would like to have reported this case as a positive test for a malignant lesion; however, after consultation with Dr. Eisenburg, it was felt it would be best to retain the criteria which were outlined formally in his paper.

There are two conclusions that may be drawn: First, iris lesions may not be so malignant when they are located solely in the iris and do not involve the choroid or ciliary body, and when they tend to show a lower metabolic turnover of P^{32}; second, as Dr. Fry suggested, the criteria for the evaluation of the P^{32} test for iris lesions must be revised.

ITCHING OF THE EYES

DR. THOMAS H. COWAN: The physiologic principles of itching in general and their application to specialized ocular areas were first considered. A clinical experiment was described in which itch-provoking stimuli were applied to various parts of the ocular region in an attempt to ascertain where and how itching was most easily aroused so that the source of pathologic itching might be indicated. The causes of some clinical cases of itching were described. The results can be summarized as follows:

1. The theories of itching in general can be applied to the eye with reservations. The cornea, supplied with pain fibers only, does not constitute a source of itching, according to the techniques used. The limbus and bulbar conjunctiva can only be induced to itch with difficulty and when highly sensitized by a pathologic condition or allergy.

2. The conjunctiva of the lids definitely responds to stimulation with itching, thus giving a clear-cut example of the ability of mucous membrane to itch.

3. The skin of the lids responds to stimuli in the same way as the skin elsewhere.

4. The area of the lid margins, together with the cilia, respond to itch-provoking stimuli more readily than other parts. Some obscure causes of pathologic ocular itching originate here.

5. Stimulation of the itch-sensitized areas

around the eyes reproduces the clinical symptoms, and removal of the sensitizing and irritating agent causes cessation of itching.

January 19, 1956

Dr. I. S. Tassman, *chairman*

Endothelial dystrophy and multiple malignant melanomas

Dr. William C. Frayer: A 59-year-old woman with bilateral endothelial dystrophy and a progressively enlarging melanoma of the iris and ciliary body was followed for five years. Following enucleation of the left eye, a second malignant melanoma was found in the choroid. This had not been noted clinically. These two malignant melanomas were thought to be independent primary growths. Histopathologic studies also revealed corneal changes characteristic of cornea guttata or endothelial dystrophy.

A review of the literature revealed only one previous report of multiple primary malignant melanomas in a single eye which appeared to fulfill the criteria for independent tumor growth. Only eight previous histopathologic reports of eyes with endothelial dystrophy could be found in the literature.

Turbidimetric measurement of streptococcal antihyaluronidase

Dr. Joseph W. Hallett and Dr. Irving H. Leopold: Hemolytic streptococcal hyaluronidase evokes antibody formation. Nongranulomatous uveitis is said to be principally due to hemolytic streptococcal infection. Increased antihyaluronidase activity of the blood has been reported in chronic simple glaucoma. In this study, blood serum antihyaluronidase levels were determined turbidimetrically in 326 normal, 90 uveitis, and 40 chronic simple glaucoma patients. Thirty-two of the uveitis cases had follow-up levels performed. No increase in the geometric mean titer over that of the normal controls was found in any group. The index range difference indicated very slight value of the test only in nongranulomatous uveitis. Fluctuations in the titer may be of more significance in uveitis than a single test.

Ophthalmology in India

Dr. Richard A. Ellis: While working with various missionary ophthalmologists in villages of India and Pakistan during the 1954 to 1955 season, I noted many differences in the practice of ophthalmology from that in the United States. The reasons for these great changes in our specialty are due to the social and economic conditions in that part of the world. There is an acute shortage of well-trained physicians and poverty is extreme. Many of the people are superstitious and the caste system, though outlawed, still exists in the villages. The practice of quackery flourishes. Approximately 90 percent of the people are illiterate and sanitation is practically nonexistent. Facilities for transportation and communication are primitive. The weather is favorable only one third of the year, and it is either too hot or rains constantly during the remainder of the year. Therefore, the majority of patients are treated during the four months of the winter. Therefore, when a patient does present himself, one treats him to the fullest extent since it is unlikely that the patient will ever again see a trained ophthalmologist.

Besides having all of the diseases that we have in the United States, there are many eye conditions which are rarely found in our country. There are many cases of vitamin-A deficiency, with the typical finding of night blindness, xerosis, Bitôt's spots, and keratomalacia. Trachoma seemed to be present in the majority of the patients that I examined. There are also many cases of leprosy and smallpox with eye involvement. Ocular infections are more common because of the lack of sanitation and the unavailability of antibiotics. The incidence of glaucoma may be more frequent due to the increase in the untreated secondary types. Cataracts also appear to be more numerous in this section of the world and the end-results of some

couching operations done by the quacks are occasionally seen. It is noteworthy that no cases of retrolental fibroplasia were seen.

The great bulk of the practice of ophthalmology consists of eye surgery. Cataract extraction is the most frequent operation performed. During the winter months usually from 20 to over 100 cases are performed a day. Three operating tables are used at the same time so there is no loss of time. The surgeon goes from table to table. Usually cataracts are removed bilaterally at the same sitting. The nurses give the local anesthesia and occasionally, if needed, the surgeon repeats the anesthetic injection. Graefe-knife incisions are most popular and three corneoscleral sutures are used in each case. The patients are discharged after eight to 10 days of postoperative care at which time the sutures are removed. Most patients are given a simple +10D. sph. lens unless they request a complete refraction. Any complicated cases are kept as long as needed.

Glaucoma surgery is the second most common type of ocular procedure. Because the patients will not use miotic therapy, the diagnosis of open-angle or narrow-angle glaucoma would be the indication for glaucoma surgery.

Plastic repair for entropion secondary to trachoma is the next most frequent type of surgery. Dacryocystorhinostomies and optical iridectomies are other surgical procedures. Because of religious beliefs enucleations are very rarely performed.

Eye surgery is performed in "eye camps" as well as hospitals. In these "eye camps" from 50 to a few hundred operations are performed in one to two days. This surgery takes place in tents or small buildings in the villages and the patients are also followed for eight to 10 days. In spite of all the handicaps, the operative results are very gratifying.

The treatment of eye disease may vary in the large cities. However, since 85 percent of the population is concentrated in rural areas, I believe that the picture I have presented is more indicative of the practice of ophthalmology in India.

William E. Krewson, 3rd,
Clerk.

Ophthalmic Miniature

A case of facies ruber medici

A 26-year-old patient who had been seen on previous occasions because of corneal scars following trachoma in his childhood, associated with high myopia, complained of a burning sensation in his eye.

He was examined with the slitlamp, and the left eye showed numerous dustlike iridescent particles in the anterior chamber and also on the iris surface. The pupil was deep-black and did not react to light. The possibility of cholesterol crystals in the anterior chamber was considered.

During the examination the patient was restless and almost hostile, making a more careful observation impossible. Further studies were abandoned when he pointed out that this was his glass eye.

John J. Stern, M.D.,
Utica, New York.

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THE EYE-BANK COMMITTEE

In 1955, at the time of the convention of the American Academy of Ophthalmology and Otolaryngology, representatives from 12 eye-banks met to discuss the possibility of establishing an organization of eye-banks. At that time is was decided to meet again on the first day of the Academy convention in 1956 to discuss the problem further. As a result, ophthalmologists of all eye-banks were invited to attend the meeting which took place at the Palmer House on Sunday night, October 14, 1956. Twenty-seven ophthalmologists attended.

In the meantime, the committee appointed by the Section of Ophthalmology of the American Academy of Ophthalmology and Otolaryngology, under the chairmanship of Derrick Vail, to collect available information on the number and function of the eye-

banks in the United States had made its report. They found that there were 20 eye-banks located in various parts of the country, 11 in the eastern states, four in the middle states, one in the south, and four in the western states. They further found that 13 banks were either controlled directly by ophthalmologists or had ophthalmologists on the board of control. The other seven were run by lay organizations. Scientific laboratory facilities were available to 10 banks. They found that only five eye-banks were affiliated with medical schools.

The committee found that there is a wide variation in the organization and scientific qualities of the eye-banks, from those that appear to be solely money-making schemes and for exploitation to a very few of the highest scientific and ethical ones, for example, The Eye-Bank for Sight Restoration, Inc., New York.

They pointed out that this has resulted in a serious competition for funds and particularly for material. There is, therefore, a distressing confusion in the minds of the people, which in the end could defeat the purposes of the eye-banks. They further found that in the eye-banks where there is no control of either policy, funds, or publicity by ophthalmologists, there is a notorious disregard for medical ethics and scientific endeavor. In the eye-banks that are under the control of ophthalmologists and those that are associated with laboratories, first-class hospitals, or universities, there is excellent ethical control of funds and publicity. The scientific work done by these institutions has been excellent.

It was pointed out that the emotional appeal of the work is such that the eye-banks have been exploited by unscrupulous organizations and individuals to the detriment of the public and to the disadvantage of scientific ophthalmology, problems that are difficult to control.

As a result of their investigation, the committee recommended, among other things, the formation of a standing committee of ophthalmologists formed jointly by the Section on Ophthalmology of the A.M.A., the American Ophthalmological Society, the Academy of Ophthalmology and Otolaryngology, and the Association for Research in Ophthalmology, to be known as the Joint Committee on Eye-Banks, two members to be appointed from each organization. This committee is to be empowered to choose its own officers and form its own organization along the lines that seem best to them regarding its function. The suggestion was approved and the committee was formed and is composed of the following men: Ramon Castroviejo, Phinizy Calhoun, Jr., from the Section of Ophthalmology; A. D. Ruedemann, R. Townley Paton from the American Ophthalmological Society; Alson Braley and Harry King from the Academy; Michael J. Hogan and Alfred E. Maumenee from the Association for Research in Ophthalmology.

At the time of the meeting of eye-bank representatives in Chicago, this report was available, and the chairman of that committee, Derrick Vail, reported the findings to the group. The personnel of the new Joint Committee on Eye-Banks was announced.

This was followed by a generalized discussion which resulted in a number of important suggestions for the committee to consider.

It is felt that some form of eye-bank organization is desirable, this to be composed of all acceptable eye-banks, the governing body possibly being composed of the members of the joint committee. A meeting could be held once a year at which problems and matters of importance to the eye-banks could be presented and discussed.

In addition, there should be a central clearing house for available material so that if there is an excess of eyes in one bank the material could be used elsewhere.

The publicity that has been used in the past in an attempt to create greater interest in a drive for funds has often been very bad. For example, one organization, in an appeal

for funds, stated that the donated eyes are used "for research in our modern, well-equipped research laboratory to find cures for eye diseases and ways and means to prevent blindness. Our recent discovery of a cure for detached retinas will prevent blindness from that cause to all persons everywhere, forever," and again, "no one need go blind anymore anywhere because of a detached retina." These statements were made in a lay organization drive for funds. One national lay organization has made eye-banks its project and has collected large sums of money for this purpose. The publicity has often been very bad. This organization, composed of outstanding citizens, who are sincere in their effort, has not had the opportunity of obtaining advice and guidance from a committee or organization composed of the authorities on eye-banks. The newly appointed committee and organization could be most helpful in advising the proper type of publicity and helping to set up the policies of conducting an ethical eye-bank.

The importance of research centers associated with eye-banks should also be stressed. Many laymen are unaware of the fact that, after the cornea has been removed, the eye has very definite values as material for research and study. The setting up of these suitable research facilities in conjunction with the establishment of eye-banks could be pointed out to lay organizations when they consider their budget. It would seem that the co-operation of the eye-bank committee or organization would be of great mutual benefit.

Another important function of the committee will be to try to obtain uniform legislation regarding the obtaining of eyes at autopsy. At the present time there is a great variance in this matter. In some localities the removal of eyes is now included in a permission for autopsy. Also, with the increased use of vitreous, it would be important to determine legally whether or not vitreous is included under "body fluids." As stated in a previous editorial it is most important that the ophthalmologist be thoroughly familiar with his local laws regarding the removal of eyes and that he comply with them.

Another point brought out rather forcefully at the meeting was the fact that the eye-banks should be under the control of ophthalmologists so that funds are not wasted and that the greatest possible good can accrue to the patient.

The value of such an organization in regard to method of obtaining, transporting, and preserving corneal material and vitreous is self-evident and need not be stressed.

It is felt that in the formation of a Joint Eye-Bank Committee a great forward step has been taken. It is hoped this committee takes its responsibility seriously and that, among other things, it sets up the establishment of an organization of eye-banks. Another one of the important functions will be the co-operation with those lay groups who are sincerely and ethically attempting to provide real help in the field of corneal transplant.

Frederick C. Cordes.

CORRESPONDENCE

Clinical value of Rodenstock refractometer

Editor,
American Journal of Ophthalmology:

The July, 1956, issue of The American Journal of Ophthalmology contains a paper "The clinical value of the Rodenstock refractometer" by Dr. Frank I. Hobbs and Dr. Robert A. Schimek. My paper, "Objective methods of refraction," which also dealt with the Rodenstock refractometer appeared in May, 1955, issue of The Journal. Since the results of these two papers are at variance, I would like to make some comments concerning the paper of Hobbs and Schimek. Although the number of eyes which I examined was considerably smaller than that of Hobbs and Schimek, the series was suffici-

ently large to lend itself well to statistical analysis.

In the Hobbs and Schimek paper, no age distribution of the patients is given. The total number of eyes examined by them was 479 with cycloplegic refraction being performed on 361, or 77 percent. Since cycloplegic refraction is generally limited to younger age groups, does this high percentage of cycloplegic refractions indicate an unusually large number of younger patients in their distribution? The pupil size of young individuals is usually larger than that of older individuals and, as I have indicated in my paper, the refractometer may be less accurate as a consequence of a small pupil in the examined eye. Thus the smaller average error found by Dr. Hobbs and Dr. Schimek for the refractometer as compared to the average error which I found when the refractometer was used without cycloplegia may be the result of the instrument being tested on a skewed age distribution of patients, with an excess of young individuals.

Dr. Hobbs and Dr. Schimek have determined the spherical errors of the Rodenstock refractometer used without cycloplegia, by calculating the differences from the cycloplegic subjective examinations (see their graph 1). In essence, what they have done in this case is to determine the difference in the results obtained by one method of examination on one distinct group from the results obtained by another method of examination on another distinct group of eyes. This is true since the use of cycloplegia has created an entirely new sample. Refractionists are aware of the large difference which can be found in the refractive status of an eye which has been examined with and without cycloplegia, by objective and subjective methods. Hence a question can be raised as to the validity of evaluating the refractometer with sample material which is not identical with that being used for comparison.

Dr. Hobbs and Dr. Schimek refer to the standard deviation curve and the conformation of the Rodenstock errors about such a curve. I assume that what they mean by "standard deviation curve" is the normal frequency distribution curve or normal probability curve. The fact that the Rodenstock errors conform to such a curve does not per se indicate that the instrument is a good clinical tool. Most biologic measures conform to a normal distribution curve. What is desirable is that the errors show a minimum of dispersion, that is, a reasonably narrow range. An analysis of their data in Graph 1 reveals a wide range of errors for the refractometer. Eighteen percent of the eyes examined with the refractometer were in error from minus 0.75 diopters to minus 3.00 diopters and eight percent were in error from plus 0.75 diopters to plus 2.75 diopters. Thus more than one fourth of the refractometer determinations differed from the subjective cycloplegic refractions by plus or minus 0.75 diopters or more. This certainly represents more than an occasional large error.

In Graph 5, an inspection of the data reveals that more than one fifth of the refractometer errors were plus or minus 0.75 diopters or more, with a range of errors from minus 2.75 diopters to plus 3.00 diopters. The fact that the distribution of errors for the refractometer has shifted somewhat toward the plus side indicates one of two conditions: (1) Either the technician operating the refractometer is biased in the direction of insufficient minus or too much plus, or (2) the examiner performing the subjective examination is undercorrecting with plus or overcorrecting with minus. Graphs 2 and 6 also show a wide range of errors for cylinder determination (minus 2.50 diopters to plus 2.00 diopters).

In view of the above-mentioned frequency and range of errors for the refractometer and the greater accuracy of the retinoscope as compared to the refractometer (as shown in my paper), I do not agree with Dr. Hobbs and Dr. Schimek as to the indication for the refractometer in the "armamentarium of the

busy ophthalmologist," whether or not there be a technical assistant to perform readings.

(Signed) David Volk, M.D.
Cleveland, Ohio.

Reply to Dr. Volk

Editor,
American Journal of Ophthalmology:

Dr. Volk first asks if our "high percentage of cycloplegic refractions (77 percent) indicates an unusually large number of younger patients in their distribution?", and suggests that "the smaller average error found by Dr. Hobbs and Dr. Schimek for the refractometer as compared to the average error which (Dr. Volk) found when the refractometer was used without any cycloplegia may be the result of the instrument being tested on a skewed age distribution of patients with an excess of young individuals." We will answer this first criticism in three parts:

1. The age distribution in our series was about the same as that in Dr. Volk's series. Twenty (or 63 percent) of his patients were aged 40 years or below. The 75 percent (not 77 percent, since $361 \div 479 = 0.754$) of eyes receiving cycloplegic refractions in our series included not only patients of age 40 years or under, but a considerable number over 40 years. We wanted both a manifest and a cycloplegic refraction whenever feasible.

2. As stated in our paper, an analysis of Rodenstock "errors" according to age did not show any significant correlation.

3. A more likely explanation for the greater accuracy of our Rodenstock results over those of Dr. Volk is contained in the following quotation from our paper: "It should be emphasized that all the Rodenstock readings were done by one individual, and that facility in taking a rapid reading and getting the patient to relax his accommodation will greatly influence the results as far as accommodation is concerned. Contrariwise, much more difficulty with accommodation was experienced by the resident and staff ophthalmologists when first using the refractometer and when using it only occasionally." Dr. Volk's series contained a total of only 32 patients, while ours contained 242. Furthermore, our technician spent considerable time developing experience with the Rodenstock before the study began.

Bradford and Lawson's work, published one year previous to Dr. Volk's paper, stated: "after a preliminary trial of the instrument in several hundred refractions, a series of 70 patients was carefully studied by one of us." They also mention "preliminary studies on 450 eyes." Since Dr. Volk does not mention a specific Rodenstock training period, one naturally wonders how many patients preceded his small series of 32 patients. Skill with the Rodenstock must be developed by practice, just as with retinoscopy. Those who remember the weeks or months necessary to become an expert retinoscopist (particularly without cycloplegia) will get the point, we are sure.

Dr. Volk's second criticism objects to any comparison of the noncycloplegic Rodenstock refractometer readings with the customary cycloplegic refractions. Because we were aware that differences do exist between a cycloplegic and a manifest refraction on the same eye, the refractometer reading was separately compared with manifest refraction on each eye and then separately compared with cycloplegic refraction on each eye. This comparison with cycloplegic refraction is of considerable value as an additional check on the accuracy of the Rodenstock instrument.

It is our impression that many ophthalmologists use cycloplegic refraction as a part of their examination for a guide or estimate of the correct refraction under normal conditions. The fact that certain differences are expected between a manifest and cycloplegic refraction does not necessarily destroy all value for such a comparison.

It is well known that cycloplegic refractions reflect less average residual accommodative error than manifest refractions. The

mean Rodenstock deviations for spherical and spherical equivalent values were +0.12D. and +0.17D., respectively, when based on the manifest refraction, and −0.14D. and −0.13D. when based on the cycloplegic refraction (the values listed in our paper were in error). This indicates that for spherical and spherical equivalent values, the average Rodenstock determination was closer to the cycloplegic refraction than was manifest refraction. Therefore, the Rodenstock reading probably reflected less residual accommodative element than did the manifest refraction. Dr. Volk apparently completely rejects this probability with the explanation that either the manifest refractions were consistently undercorrected (not enough plus) or the Rodenstock determinations were biased in the direction of too much plus. The mean spherical difference between our manifest and cycloplegic refractions was only 0.26D., which seems too small to support Dr. Volk's hypothesis. (Not knowing the parameters for the population of ophthalmologists, concerning spherical differences between manifest and cycloplegic refractions, we cannot say whether our mean difference is above or below average. A priori, we expect it is about the same as the average difference between manifest and cycloplegic refraction found by the average ophthalmologist.) In regard to Dr. Volk's second hypothesis, it seems useless to debate whether the Rodenstock examiner achieved better conformation with the cycloplegic refraction by (1) skillfully reducing the accommodative element, or (2) inadvertently happening to make a consistent error which happened to cause better conformation with the cycloplegic refraction.

Graphs 1-8 in our paper are representations of frequency distributions of Rodenstock deviations from the subjectively determined refractions. To this extent, the shape and spread of these graphic representations obviously do portray the accuracy or inaccuracy of the Rodenstock instrument. Further analysis might be desired beyond our somewhat oversimplified statements of the "goodness of fit" between our graphs of the frequency distributions and "normal" frequency distribution curves for equivalent means and standard deviations. It would be more accurate to describe these graphic frequency distributions as single humped and bell-shaped, and not more than moderately skewed, though somewhat leptokurtic. Such variations from "normality" are the rule rather than the exception in studies such as this. In any event, the important feature of our graphs of the frequency distribution is that they permit a visual and statistical analysis of the accuracy or inaccuracy of the Rodenstock readings.

Our article specifically noted that the Rodenstock readings had "occasional wide variations from the usual methods of refraction." By *wide* variation, we had in mind something over one diopter of error. Less than one out of every 16 eyes had a spherical Rodenstock error of over one diopter, and less than one out of every 29 eyes had a cylindrical Rodenstock error of over one diopter, if one compares Rodenstock readings with the manifest refraction (graphs 5 and 6). Parenthetically, it is surprising that Dr. Volk chooses to compare the noncycloplegic Rodenstock with the cycloplegic refractions (graph 1), after previously objecting to this very comparison.

Dr. Volk disagrees with our feeling that there could be a place in the busy refractionist's armamentarium for the Rodenstock with a technical assistant to perform the readings. A technical assistant is specified because we prefer to use the retinoscope for our own testing (as stated in the paper). We personally do not believe the place of the present Rodenstock model will be prominent in office practice, nor do we think it should replace retinoscopy. However, there are facts in favor of the Rodenstock which must be considered.

In our experience, it was of some value during a routine refraction to have a noncycloplegic Rodenstock reading as an approximate guide to the refractive error.

Also, when subjective methods of refraction are not possible, it can serve as an extra check on other objective methods such as retinoscopy.

Bradford and Lawson stated in their summary that "The Rodenstock refractometer seems to be a relatively easy, rapid, and accurate objective means of determining the refractive error under cycloplegia, the results being comparable to those obtained with streak retinoscopy." Thus, use of the Rodenstock with cycloplegia alone would seem to qualify it for a place in the refractionist's armamentarium.

In summary, although we should remain conservative about interpreting the practical office applications of (1) our noncycloplegic Rodenstock findings and (2) Bradford and Lawson's cycloplegic Rodenstock findings, we still feel more optimistic than Dr. Volk's closing statement that there is no indication for the refractometer in the armamentarium of the busy ophthalmologist whether or not there be a technical assistant to perform readings.

(Signed) Frank I. Hobbs, M.D.
Robert A. Schimek, M.D.
Detroit, Michigan.

BOOK REVIEWS

TUMORS OF THE EYE AND ADNEXA. By Algernon B. Reese, M.D. Published by the Armed Forces Institute of Pathology, Washington, D.C., as Section 10, Fascicle 38 of the *Atlas of Tumor Pathology*. 205 pages, 1 colored plate, 122 figures, references, no index. Price: $2.00.

This is not an inexpensive reproduction of the author's magnificent and classic *Tumors of the Eye* published in 1951 by Paul B. Hoeber, Inc. To be sure there are a number of illustrations that are reproduced here, but the text shows considerable evidence of rewriting and cutting down, by hard but rewarding work. It is printed on excellent glossy paper and the illustrations are clear and sharp. It is a supplement to *Tumors of the Eye* and cannot replace it. It is a bargain put out by a benevolent government (us) and any ophthalmologist who doesn't possess a copy should consult a psychiatric colleague as soon as possible.

The contents consist of generously illustrated texts on epithelial and neuro-ectodermal tumors, melanomas, mesodermal tumors, tumors of the lacrimal gland, metastatic tumors, and orbital neoplasms and lesions simulating them. The text is lucid and to the point. It is overwhelmingly recommended.

Derrick Vail.

THE STRESS OF LIFE. By Hans Selye, M.D. New York, McGraw-Hill Book Co., 1956. 324 pages, index. Price: $5.95.

Selye, since 1945 director of the Institute of Experimental Medicine and Surgery at the University of Montreal, has been investigating the problem of stress since 1936. He has now 53 assistants helping him in research. He defines stress as a condition embodying the sum of all the nonspecific effects of stressors (noxious agents). The word "stress" has been introduced as such into all foreign languages as it cannot be precisely translated.

His discussion systematically covers (1) the evolution of the stress concept from the earliest records of medical thought up to the present time; (2) the mechanics through which our body is attacked by, and can defend itself against, stress-producing situations; (3) the diseases of adaptation which result from failures in the stress-fighting mechanism; (4) a unified theory—that all the manifestations of normal and pathologic life depend only on when, where, and how much its biologic elements are stressed; and (5) implications and applications.

The body meets the most diverse aggressions with the same adaptive-defensive mechanism but sometimes the response may be too weak or too strong. Diseases of adaptation are those maladies in which an

imperfect response of the general adaptation syndrome plays the major role. Adaptation manifests two phases, or sometimes three, consisting of the alarm reaction (adrenocortical enlargement, thymicolymphatic atrophy, and loss of weight), the stage of resistance and—if this is inadequate—the stage of exhaustion. Stress, applied in moderation, is necessary for life. Everyone must experience the first two stages again and again; otherwise man would never become adapted to perform the activities and resist the injuries and infections which are his lot.

Selye envisions far-reaching philosophic implications. "The incitement, by our actions, of gratitude in others is most likely to assure our security within society. Why not seek this consciously as a long-range aim in life?"

The jacket contains the following statement: "Here, in language easily understandable by the general reader, the man who has been called 'the Einstein of Medicine' explains his stress concept." Since this book was intended for both layman and scientist, the repeated use of arbitrary abbreviations should have been avoided.

James E. Lebensohn.

J.A.M.A. Queries and Minor Notes. St. Louis, C. V. Mosby, 1956. (Published for the American Medical Association.) 334 pages. Price: $5.50.

The column entitled "Queries and minor notes" appearing in the *Journal of the American Medical Association* has long been popular with readers and some of the more interesting items have been reprinted in this book. The material is arranged and indexed according to the *Standard Nomenclature of Diseases and Operations* so that one can find the material in any special field without difficulty. Twenty-six items on the eye are included, ranging from "After-image in color-blind persons" to "Xanthopia following snake bite."

The intriguing thing about this feature in the *J.A.M.A.* is the fact that the questions are those submitted by practicing physicians (name usually signed) who have been unable to find the answer to their particular problems and that the answers are by competent authorities, who, by A.M.A. policy, are anonymous. It would add further interest and authority if the replies were signed. Since many of the questions raised are unique the book becomes of interest, not as a textbook, but as an interesting means of acquiring information on little-known subjects.

William A. Mann.

Paper Electrophoresis. Ciba Foundation Symposium. Edited by G. E. W. Wolstenhome and E. C. P. Millar. Boston, Little, Brown & Company, 1956. 224 pages, 74 illustrations, index. Price: $6.75.

Paper electrophoretic technique has become an increasingly important diagnostic tool. In this volume the world's leading experts in this field detail the methods of paper electrophoresis and their use in medical and biochemical problems. Electrophoresis on filter paper is a simple alternative to the complicated procedure of free electrophoresis introduced by Tiselius in 1937 and has many advantages over the latter. Paper electrophoresis permits the simultaneous analysis, in the same sample, of proteins, lipids, and the protein-bound carbohydrates, and, by staining and other means, various substances which are part of the protein can also be determined. About 4,000 reports have been published dealing with the manifold applications of paper electrophoresis, including a notable number relating to the biochemistry of the eye.

Since 1949 the Ciba Foundation has sponsored five or six such symposia annually; and 20 specialized volumes such as this have been published to date.

James E. Lebensohn.

DOCUMENTA OPHTHALMOLOGICA. Advances in Ophthalmology. Edited by von Bahr, von Bünau, François, Goldmann, Cascio, Müller, Nordmann, Schaeffer, and Sorsby. 'S-Gravenhage, the Netherlands, W. Junk, 1956. Volume IX, Fasc. 2, 215 pages. Price: Not listed.

Fascicle 2 completes Volume IX of this excellent publication. As usual, it consists of contributions of the highest scientific value to ophthalmology. There are four papers. Motokawa studies "Color contrast and physiological induction in human and mammalian retina" (in English). He emphasizes that inhibition instead of fatigue should be assumed for explanation of contrast, most adequately in terms of "postinhibitory rebound." Inhibition is really a fundamental process in color vision.

E. N. Willmer reports his studies on "A physiological basis for colour vision in the central fovea" (in English). It is a most scholarly review and comparison of luminosity and color vision data for the foveal centers of protanopes, deuteranopes, and normal subjects. The author presents some evidence that the carotenoid visual pigments activate the two types of receptors which function in the normal human fovea, and that luminosity is determined by a mechanism close to the receptors, presumably in the polysynaptic "flat" and "brush" bipolar cells.

The next paper, "Indications, according to their mode of action, for the different medical and surgical treatments of ocular hypertension" (in French), is by Weekers, Prijot, and Delmarcelle. Their aim is to classify treatment into whether one wishes to reduce the resistance to outflow or reduce the flow of aqueous itself. It is a sound paper, based on a good number of representative cases of the various kinds of ocular hypertension.

The final contribution is by François, Verriest, and De Rouck, who report their studies on "Congenital achromatopsia" (in French). They have collected from the literature and thoroughly analyzed 215 cases of complete congenital color blindness with amblyopia, 15 incomplete cases with amblyopia, 15 cases without amblyopia, and two cases of unilateral achromatopsia. They add three cases of the latter from their own clinic and they discuss the different theories involved.

Documenta Ophthalmologica first appeared in 1938. The second volume came out in 1949 and others annually since then. Its list of contributors in this time includes the most eminent names in experimental ophthalmology throughout the world. Each article is actually a monograph of its subject, and is printed in English, French, or German, as the author may desire. Recently, short but adequate summaries are printed in all three languages. This is a great help to most of us. Many of the articles have important clinical value and are attractive to the clinician on that account. The *Documenta* thus are an important addition to our ophthalmic literature and should be more widely recognized.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

5

DIAGNOSIS AND THERAPY

Swan, Kenneth C. **New drugs and techniques for ocular anesthesia.** Tr. Am. Acad. Ophth. **60**:370-375, May-June, 1956.

The author describes benoxinate, dyclonine, and ophthaine as being short acting, highly effective and of minimal toxicity. He also discusses techniques of injection anesthesia. (5 figures, 2 tables, 15 references) Theodore M. Shapira.

Törnquist, Ragnar. **An instrument for measuring pupil diameters in darkness.** Acta Ophth. **33**:551-555, 1955.

The author describes an apparatus, manufactured in Goteborg, designed to measure the size of the pupil in darkness, and capable of detecting 0.1 to 0.2 mm. differences. (3 figures, 8 references) Ray K. Daily.

Vannas, Mauno. **Pocket graft, a simple and safe form of transplanting skin and mucous membrane.** Acta Ophth. **33**:471-488, 1955.

This detailed and well illustrated description of the author's method of repair of defects about the eyes is based on experience in 128 cases. This method differs from Keller's tunnel graft in that the graft, attached to a stent of X-ray film or acrylic, is buried in a pocket under the defect for 7 to 10 days before the cicatricial tissue is excised and the graft fitted into the proper position. The graft of skin or mucous membrane, held smoothly by the supporting plate for 7 to 10 days, is thus given time to fuse with the underlying tissue. After that, the original incision is reopened, the supporting plate removed, the cicatricial tissue excised, or retracted, and the healthy tissue sutured to the edges of the graft. (12 figures, 10 references) Ray K. Daily.

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OCULAR MOTILITY

Alpern, M. and Wolter, J. R. **The relation of horizontal saccadic and vergence movements.** A.M.A. Arch. Ophth. **56**:685-690, Nov., 1956.

The authors say that the saccadic movements are rapid, but that the vergence movements are much slower. (6 figures, 17 references) G. S. Tyner.

Burian, Hermann M. **Non-surgical treatment of comitant strabismus.** Illinois M. J. **110**:101-109, Sept., 1956.

This is an excellent review of the personal opinions of an authority on ocular motility which deserves wide reading by ophthalmologists. While surgery offers the only permanent method of straightening crossed eyes due to mechanical causes, nonsurgical methods should be exhausted first. Small children accept an excess of plus sphere which older strabismus patients would reject. Bifocal glasses are recommended in certain cases. It requires only two months to determine if glasses are sufficient treatment, but six months are required in case prisms are prescribed.

Atropine is considered poor treatment, but miotics are recommended to reduce accommodative convergence. Occlusion is required and should be used in every case of suppression amblyopia. It must be total and constant. Parents should be warned that occlusion may cause greater esotropia, a blur of the formerly dominant eye, nervousness, and even stammering. It is easy to improve vision from 20/50 to 20/30, but hard to get from 20/30 to 20/25. Occlusion should change monocular heterotropia to alternating.

Orthoptic training is of value in analysis of patients about to undergo surgery and to improve fusional amplitudes after surgery. It is not to be used on every patient, nor longer than indicated by noticeable improvement. Paul W. Miles.

François, J. **Treatment of concomitant strabismus. A comparative study of late results in different age groups.** Bull. Soc. belge d'opht. **122**:214-221, March, 1956.

The results of medical and surgical treatment in concomitant convergent squint during 1951 and 1952 are reviewed. The group included 594 patients. They were divided in five subgroups dependent on the type of treatment: 1. orthoptics only, 2. orthoptics and surgery, 3. presence of monocular amblyopia 4. presence of binocular vision, and 5. absence of binocular vision. Early orthoptic training between 2 and 4 years of age is advised. Early operation is suggested for children who have accommodative esotropia and binocular vision but whose eyes nevertheless can not keep straight all of the time. Surgery can be postponed if the vision in the amblyopic eye can be kept at the desired level. The difficulties in the evaluation of visual accomplishments in small children is recognized. In spite of favorable immediate postsurgical results the patients should be kept in close observation for several years. (5 tables)

Alice R. Deutsch.

François, J. and Derouck, A. **An electro-oculographic study of ocular paralyses.** Acta Ophth. **33**:523-550, 1955.

The literature in this field is reviewed, and the authors' equipment for measurement and amplified recording of the electrical response to ocular movements is described in detail. The factors affecting the electromyogram, such as the psychic state of the patient, the condition of the retina, the amplitude and rapidity of ocular movements are discussed. A study of 10 patients with various paralyses of the extraocular muscles are reported and the electromyographic charts described and illustrated. The summary points out that in the ocular palsies, complete or incomplete, the oculographic record taken during the rotation of the eyeball, caused by the contraction of the paralyzed muscle, presents characteristic modifications: no deflection of all of the isoelectric line, irregular deflection, diminished amplitude, and nystagniform movements. In slight or recovered ocular palsies, modifications of the oculographic record may appear only for small movements, such as those produced by reading or in optokinetic nystagmus. (33 figures, 26 references)

Ray K. Daily.

François, P., Woillez, M. and Bernard. **Late development of binocular vision in a**

case of esotropia, dating from early childhood. Bull. Soc. belge d'opht. **112**:143-146, March, 1956.

The history of a 20-year-old student is discussed in detail. This girl had been cross-eyed since early infancy. In spite of the fact that several paternal and maternal family members had strabismus of varying degree the patient only started to wear glasses when she was eight years old. Orthoptic training and two operations performed later did not change the position of the eyes. When she was 20 years old she had a visual acuity of 10/10 with −.75 in her right eye and 10/70 with +1.00 in her left eye. The retinal correspondence varied from normal to abnormal. The objective angle of squint equaled 26$^{\Delta}$, and there was a vertical deviation of 1 to 4$^{\Delta}$. There was no binocular vision and there was a suppression zone between +8 and −2°. Orthoptic exercises were started and two months later a 4 mm. recession of the right internal rectus muscle and a 6 mm. resection of the right external rectus were performed, with satisfactory cosmetic and surprisingly good functional result. Binocular vision developed abruptly about two months after surgery.

Several theories on fusion are reviewed. Attention is called to the many still unknown facts concerning the physio-pathology of binocular vision.

Alice R. Deutsch.

Fritz, A. **False projection and abnormal correspondence in concomitant strabismus.** Bull. Soc. belge d'opht. **112**:207-214, March, 1956.

The mechanisms of abnormal correspondence is discussed and methods for improvement of these abnormal responses are described. Alice A. Deutsch.

Hacourt, J., Daenen, P. and O'Driscoll, P. **Binocular function in children after squint operation.** Bull. Soc. belge d'opht. **112**:222-226, March, 1956.

Early surgery in children with esotropias noticeable during infancy is recommended. The prognosis of this type of squint depends on the date of the appearance of the squint, the consistency in the deviation and the time interval between the development of the strabismus and the beginning of treatment. Good cosmetic and functional results were obtained even in congenital strabismus when surgery was performed before the second birthday, in spite of the great difficulties with pre- and postsurgical examinations and especially in the interpretation of coincident vertical deviations. Alice R. Deutsch.

Hambresin, L. and de Muelenaere, H. **Blind spot mechanism and ocular deviations.** Bull. Soc. belge d'opht. **112**:174-178, March, 1956.

The blind spot mechanism evidently affects the amount of objective deviation in cases of alternating esotropia because it has a subjective benefit for the patient. This mechanism prevents diplopia and visual confusion in squints of 15° with normal correspondence, in squints of 15° or more with abnormal harmonious correspondence and in squints of more than 30° with abnormal subharmonious correspondence. The blind spot mechanism also might explain failures in medical and surgical treatment of strabismus. Even after excellent postsurgical results recurrences of the esotropia were observed in cases of this kind either because of an absence of fusion or an inability to hold fusion for any length of time or because of a residual cyclophoria or more or less pronounced hyperphoria. The objective angle of squint in alternating esotropia is determined objectively by a variety of conditions; it also depends on the subjective requirements for which the blind spot mechanism is of importance.

Alice R. Deutsch.

de Jaeger, A. and Bernolet, J. **Unconditioned reflexes in strabismus.** Bull. Soc. belge d'opht. **112**:185-192, March, 1956.

In this interesting study the problem of heterotropias is approached from the viewpoint of experimental psychology. An explanation for the development of heterotropias which are not purely of ocular origin is sought. Strabismus is exclusively found in primates. It is caused by inadequate maturation and presents one type of primitive monocular vision. Strabismus, basically, depends on conditioned reflexes to avoid diplopia. These reflexes are deviations of the eyeballs, inhibition of macular vision and abnormal correspondence. A heterotropia should be treated early in life to prevent the conditioned reflexes from becoming firmly established. Whenever the strabismus is well established and the patient has reached ocular maturity it is practically impossible to bring about binocular vision by any kind of medical or surgical treatment. Alice R. Deutsch.

Reed, H. and Israels, S. **Congenital ocular motor apraxia. A form of horizontal gaze palsy.** Brit. J. Ophth. **40**:444-448, July, 1956.

The condition of congenital ocular motor apraxia was first described by Cogan as a syndrome in which the vertical conjugate movements are normal but the lateral conjugate rotations are not. In the voluntary lateral gaze the head is jerked toward the object and the eyes rotate in the opposite direction. A five-year-old boy is described who presented the picture recognized by Cogan and who seemed to be perfectly normal in all other respects. (3 illustrations, 6 references)

Morris Kaplan.

de Saint-Martin, Raymond. **A case of extreme concomitant strabismus in a very young child.** Bull. Soc. belge d'opht. **112**: 138-143, March, 1956.

Extreme esotropia with diplopia in emmetropes, mild hypermetropes or myopes is a rare and noteworthy abnormality. Only 15 cases of this kind have been published to date. This kind of strabismus develops suddenly in adults or children with a latent esophoria and unstable fusion abilities. The sudden occurence might be referred to emotional upsets of various kinds. This type of esotropia mostly is monocular, the motility of the eyes is normal, the squint-angle is pronounced and stable. There frequently is no difference in the visual acuity between the two eyes. Spontaneous recovery is rare, but even after minor surgical procedures the recovery is complete and fusion becomes well established. The case of a child, four-and-a-half years old, is reviewed. A 10 mm. resection of both external rectus muscles effected a cosmetic and functional cure. (7 references)

Alice R. Deutsch.

Starkiewisz, W. **Basic problems of etiology and pathogenesis of squint.** Ref. XXV Zjazdu Okul. Polskich 307-332, 1956.

The author discusses the problem of strabismus with reference to conditioned and unconditioned reflexes. Retinal correspondence and functional field losses and Keiner's views on the etiology of strabismus are considered. (15 figures, 15 references) F. H. Haessler.

Weekers, R., Moureau, P., Hacourt, J. and André, A. **A contribution to the etiology of concomitant squint and on amblyopia, based on the study of identical and fraternal twins.** Bull. Soc. belge d'opht. **112**:146-173, March, 1956.

Ametropias are genetic anomalies. Amblyopias, strabismus and various anomalies of binocular vision should be considered as facultative complications of anomalies of refraction and not as dependent on the laws of heredity. Experimental

studies on this subject and anatomic and pathologic investigations met nearly insurmountable obstacles. Analysis of clinical material seemed to be the only means of observation and the study of twins is promising. Seven pairs of identical twins and eight pairs of nonidentical twins were investigated. Identical twins showed identical anisometropias (genetic lesions). Strabismus, amblyopia and abnormalities of binocular vision however were present only in one twin; these anomalies cannot be referred directly to genetic lesions but are dependent on the ametropia. Several pedigrees showed the effect of refraction in the cause of squint. Early and complete correction of anisometropias, definitely before school age, is considered to be an effective preventive method for strabismus, amblyopias and diverse functional anomalies. (22 figures, 2 tables, 10 references) Alice R. Deutsch.

Zanen, J. and Szuchs, S. **The achromatic and chromatic threshold of central vision in amblyopias of strabismus.** Bull. Soc. belge d'opht. **112**:193-206, March, 1956.

The thresholds of chromatic and achromatic stimuli in the central fields of normal and amblyopic eyes were studied, the findings were tabulated and evaluated and variations and discrepancies of previous experiments are explained. It is stated that as far as central vision is concerned the amblyopic eye had not only a reduction of form vision but also a diminished perception of brightness and colors; the achromatic and chromatic threshholds are higher in amblyopic than in normal eyes especially in the long-wave part of the spectrum. A certain relationship between visual acuity and chromatic and achromatic thresholds seems to exist, as patients with reduced visual acuity show high threshhold levels. Those people often have a manifest deficiency in their central perception of color and brightness. Most of those persons belonged in the 8 to 16-year group. The duration of amblyopia has a considerable influence on the amount of visual loss. (8 figures, 3 references) Alice R. Deutsch.

Zaneu, J., Weekers, R., Daenen, P., Braun-Vallon, Appelmans, M., Hoorens, M., Ricci, M. A., François, M. J., and Renard, M. G. **Discussion on the report on concommitant strabismus by Leon Coppez.** Bull. Soc. belge d'opht. **112**:125-137, March, 1956.

Zanen does not believe in the disappearance of alternating retinal function along the whole retinal surface in amblyopias. He favors the idea of an involvement of the macula only. He described a very clever apparatus for the registration of normal and abnormal retinal rhythm and for the detection of the antagonism in the rhythms in the various parts of the visual field. He also studied the antagonism and the rivalry, present not only in the form perception but also in the color perception in various parts of the visual fields. Weekers favors early operation in children who have been cross-eyed since infancy. He studied the relationship in between early surgery, amblyopia and binocular vision as well as the indication for early secondary surgery in the presence of a mild residual deviation. He has used small doses of curare successfully in squint operations. Daenen summarized the advantages of carefully repeated examinations and individual adjustment to very young children. He condemns the use of atropine in the fixing eye and warns against the indiscriminate use of orthoptics and against pronounced resections of the external rectus muscles. Mme. Bran-Vallon discussed the origin of binocular vision; she also explained her objections to surgery in very young children. Appelmans spoke on the relationship of anomalies of refraction to con-

comitant squint. Hoorens presented briefly the main points in the management of concomitant squints, modifications of alternating and partial occlusions, variations in the techniques of surgical procedures and his reasons for delayed surgery. A. Ricci described the procedures at the ophthalmological clinics in Lausanne, Switzerland. This school believes in a basic paralytic factor in most cases of convergent squint. J. François stressed the importance of follow-up studies. Late results of previously treated concomitant squints should be regularly ascertained by comparing the results in different age groups and by different methods of treatment. Renard objected to early surgery and enumerated the hazards of early operation. Alice R. Deutsch.

7

CONJUNCTIVA, CORNEA, SCLERA

Alberth, B. and Szilagyi, I. **Fixation of corneal grafts by rabbit cornea splints.** Ophthalmologica **131**:129-134, Feb., 1956.

Modifying a technique originally described by Guenther (cfr. Am. J. Ophth. 35:1546, 1952) the authors have used rabbit corneas to hold human corneal grafts in proper position during the first 8 to 12 days of the postoperative period. Large (7 to 8 mm.) human grafts are fastened in their bed by additional appositional sutures. The splinting rabbit cornea is fastened by means of sutures to the tendons of the rectus muscles or to the episclera. Fresh or stored rabbit corneas serve equally well for the purpose. For the storage process the corneas are immersed in an antibiotic mixture and then dehydrated. Such stored corneas are made ready for use by immersion in saline solution for 20 minutes followed by a 3-minute treatment in 4 percent formalin plus a dip in 40 percent formalin to toughen the edges. The results of 48 corneal transplant operations in man seem to have been satisfactory with regard to the final position of the graft. (3 figures)

Peter C. Kronfeld.

Arkin, W. **Pathology of the cornea and the therapy of its diseases.** Ref. XXV Zjazdu Okul. Polskich 277-294, 1956.

The author discusses the preservation of transparence of the cornea, its permeability and vascularization, and also metabolism, regenerative processes and immunology in the cornea. (51 references)

F. H. Haessler.

Benedict, Walter H. **Herpes zoster ophthalmicus and its treatment.** Tennessee St. M. A. J. **49**:350-354, Oct., 1956.

Corticosteroids should not be used in herpes simplex of the cornea, but they are very beneficial in ocular herpes zoster. Herpes zoster is characterized by a painful unilateral skin eruption, most frequently of the thorax. On the face, it usually affects the area of distribution of the fifth nerve. When it extends to the tip of the nose, herpes zoster almost always causes ophthalmic complications. The cause is believed to be the varicella virus. In all cases there is corneal edema with a decrease in sensitivity. The lids are edematous. From one to three days after the skin eruption, tiny subepithelial corneal infiltrates appear which coalesce and increase in the deeper strata and may cause folds in Descemet's membrane. There may be vesiculation with corneal ulcers. Later there may be nongranulomatous iritis with posterior synechiae. Late complications include unilateral Argyl Robertson pupil, iris atrophy, glaucoma, and scleritis. Ocular motor paralyses are common and transient. (7 references) Paul W. Miles.

Daktaravichene, E. **Keratoconjunctivitis sicca in hypofunction of lacrimal glands.** Vestnik oftal. **5**:73-75, Sept.-Oct., 1956.

A case of Sjøgren's syndrome is reported. The patient, aged 42 years, complained of dryness in the eyes and mouth and of photophobia. She had the beginning of menopause and chronic polyarthritis. The Schirmer test was positive. There were numerous filaments in the secretion in the conjunctival sac and the cornea showed punctiform opacities of its lower parts.

Adreno-corticotropic therapy in the form of intramuscular injections of cortisone and local therapy were applied. There was less secretion in the conjunctiva, the cornea cleared somewhat, but the Schirmer test remained unchanged.

Olga Sitchevska.

Greer, C. H. **Precancerous melanosis of the conjunctiva.** Australian and New Zealand J. Surg. **25**:258-263, May, 1956.

Precancerous melanosis is an intraepithelial proliferation originating in the basal cells of the conjunctival epithelium, or of the skin. It is analogous to Bowen's intraepithelial carcinoma or to extramammary Paget's disease when that condition can be divorced from any primary malignancy in the underlying apocrine glands. Further clinical and pathological observations are necessary before the nature, habits and relationships of precancerous melanosis can be finally understood. (8 figures, 10 references)

Ronald F. Lowe.

Koteliansky, E. **Diathermo-coagulation in tumors of the limbus and cornea.** Vestnik oftal. **5**:7-10, Sept.-Oct., 1956.

The author reports the results of treatment of eight cases of epibulbar tumor by a diathermo-coagulation in patients who were observed from two to eight years. The method is simple and it leaves a fine grayish scar. In three cases, the tumors were benign, in five, the diagnosis was epithelioma. Only in one patient was there a recurrence (the size of the tumor was rather large, 4 by 10 mm.); in three months and after two treatments by electrocoagulation the eye had to be enucleated. The author recommends this method as safe, simple and radical in epibulbar tumors.

Olga Sitchevska.

Krawawicz, T. **Results of histochemical investigations in the diseases of the cornea.** Ref. XXV Zjazdu Okul. Polskich 295-299, 1956.

Stable cells of the cornea can become transformed into typical polyblasts after appropriate stimulation. In some conditions the cells behave like phagocytes, storing vitamin C in their cytoplasm and changing their form; their distribution and behavior in the abnormal cornea was investigated. The behavior of the oxydation-reduction system of the SH protein groups and of nucleic acids in the course of keratoplasties was also followed. Histologic investigation of the repair of the injured cornea are discussed.

F. H. Haessler.

Liebman, Sumner D. **Ocular manifestations of Riley-Day syndrome.** A.M.A. Arch. Ophth. **56**:719-725, Nov., 1956.

In 1949 Riley described a syndrome called familial dysautonomia. Among many symptoms there are retarded development, difficulty in swallowing, respiratory infections, dehydration, and lack of tears on crying. The reported cases are almost all in Jewish children.

Three cases are reported illustrating primarily the corneal lesion, which resembles neuroparalytic keratitis and keratomalacia, although the corneal process may be mild. (4 figures, 5 references)

G. S. Tyner.

Melik-Musian, B. **The use of vitreous in opacities of the cornea.** Vestnik oftal. **5**: 10-13, Sept.-Oct., 1956.

The author used subconjunctival injections of 0.2 to 0.3 ml. of vitreous in partial

corneal opacities since 1953. Of 92 patients treated, 51 had leukomas, 34 maculae, and 7 nebulae. The injections are painless and results are obtained in from 4 to 30 days. If necessary, the course is repeated in a month.

Superficial opacities were absorbed faster than the deep ones. The age of the patients or of the opacities had no bearing on the results of the treatment. In 11 patients the opacities were absorbed completely and the vision was restored to normal. In 42 patients absorption of the corneal opacities was considerable and improvement of vision was fair, and in 32 patients it was slight. Some restoration of the sensitivity of the cornea was noticed too. Olga Sitchevska.

Morawiecki, J. **Immunology and pathology of the cornea in the light of new experimental data.** Ref. XXV Zjazdu Okul. Polskich 300-306, 1956.

Contrary to current belief the author's study shows, he believes, that part, at least, of the antibodies which are found in the cornea after injection of antibody into it do not arise autochthonously but are transferred to it from other tissues of the body. (13 references)

F. H. Haessler.

Ramage, J. H. and Kinnear, W. F. **Kerato-conjunctivitis sicca and the collagen diseases.** Brit. J. Ophth. **40**:416-420, July, 1956.

Keratoconjunctivitis sicca is frequently seen in middle-aged women with dryness of the nose and pharynx and is often an accompaniment of such collagen diseases as chronic polyarthritis, rheumatism, lupus erythematosis, periarteritis nodosa and acroscleroderma. The etiology is unknown but numerous although unproved causes have been suggested. The authors describe six cases of the typical dryness of the conjunctival sac associated with one of the general diseases above. Treatment of the ocular lesion is generally unsatisfactory. (31 references).

Morris Kaplan.

Roshtchin, V. and Mitzkevich, L. **Results of the work of the Eye Clinic of Kazach Medical Institute in keratoplasty (1937-1955).** Vestnik oftal. **5**:38-39, Sept.-Oct., 1956.

This is a short resume of the work during the last 18 years in which 562 partial penetrating corneal transplantations were done. In 52 percent the transplant remained transparent and the vision was improved in nearly all patients. In those cases in which the transplant became opaque, repeated keratoplasties were done.

Corneas from the cadaver preserved in sterile vaseline were used exclusively during the last 14 years. A 4 mm. trephine was used in noncomplicated corneal leucomas. This prevented the formation of synechia and secondary glaucoma. If the presence of a complicated cataract was suspected, a trephine of 6 mm. was used; this makes the extraction of the lens and the suturing of the transplant easier. In these cases the pupil was kept narrow by miotics; this prevents the iris from forming adhesions with the circular scar in the recipient cornea. A large, thin conjunctival flap is used for the fixation of the transplant. (8 photographs) Olga Sitchevska.

Sforzolini, G. S. and Malossi, M. **The ocular manifestations of Kaposi's varicelliform eruption.** Riv. oto-neuro-oftal. **30**: 519-550, Nov.-Dec., 1955.

The authors report a case of Kaposi's vericelliform eruption in an 8-months-old male infant. In addition to a cerebral lesion there was a very severe neuroparalytic keratitis. The authors present a detailed discussion of the differential diagnosis and the pathogenesis of this condition. They conclude that it is of a herpetic nature. (3 figures, 109 references)

William C. Caccamise.

Skeller, Erik. **Arcus senilis corneae. Its frequency in some ethnic groups.** Acta Ophth. **33**:622-626, 1955.

The material for this study comprises 830 pure Eskimos, 253 mixed Eskimos and Europeans, and 42 Koreans. In addition, included in this study are the data reported by Forsius on Finns. The data of the present study confirm the reports of a lower frequency in females than in males. The frequency for Finns, is 51.6 percent for males, and 49.6 for females. For the mixed Eskimos the percentage is 31.2 for males, and 28.6 for females. For unmixed Eskimos it is 15.6 percent for males and 11.7 for females. (3 tables, 3 references)

Ray K. Daily.

Vrabec, F. **Neurohistologic study of corneal dystrophies.** Ophthalmologica **131**:73-83, Feb., 1956.

Hypertrophy of the corneal nerves was found to be a characteristic histologic feature of bandshaped keratopathy and of clinically clear corneas in cases of chronic iridocyclitis. One case of nodular corneal dystrophy showed similar hypertrophic changes in the nerves of the original cornea as well as in the nerves of a full thickness corneal graft that had remained clear for five years and then undergone nodular dystrophy. The author considers the possibility of nerve changes being a factor in the pathogenesis of corneal dystrophies in general. (4 figures, 19 references)

Peter C. Kronfeld.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Edling, Nils P. G. **The roentgenological findings of the nasal sinuses in uveitis.** Acta Ophth. **33**:627-630, 1955.

The material for the analysis consists of the histories of 185 cases of uveitis; 153 were acute, and 32 chronic. In the acute cases the sinuses were normal in 129 cases, and pathologic in 24; in the chronic cases the sinuses were normal in 24 cases and pathologic in eight. The clinical course in the patients with pathological sinus findings indicated that the sinusitis had no importance for the uveitis in the acute cases, and that the two diseases appeared concurrently because of their frequency. In the chronic cases sinusitis appeared about twice as often as in the acute cases. Here too, the clinical course eliminates sinusitis as an important factor in the genesis of uveitis. It may however have been a contributing factor to the chronic course of the process. (3 references)

Ray K. Daily.

Friede, Reinhard. **Excision of a malignant tumor of the ciliary body.** Ophthalmologica **131**:168-172, March, 1956.

Clinical examination of the 41-year-old patient revealed a yellowish-white tumor of the upper quadrant of the ciliary body protruding into the vitreous. Vision, eye ground, external findings, as well as the patient's other eye were normal. Exploration of the upper portion of the ciliary body by incising the sclera along the upper limbus and raising a large, equator-based scleral flap revealed an apparently well circumscribed tumor, about 10 or 12 mm. in diameter, involving the entire thickness of the ciliary body. Friede was able to excise the tumor without loss of vitreous or major hemorrhage. The pathologic report was spindle-cell sarcoma, extending to the very edge of the specimen. In view of this report the eye was enucleated 6 days later. Pathologic examination of the globe failed to reveal tumor tissue. The principal purpose of the publication is to show that the extirpation of tumors of the ciliary body is feasible. (5 figures)

Peter C. Kronfeld.

Hallden, Ulf. **Malignant melanoma of the choroid clinically simulating scleritis associated with retinal detachment.** Acta Ophth. **33**:488-491, 1955.

A woman, 35 years old, was found to have a scleritis and retinal detachment; the retina was covered with white masses regarded as a fibrinous exudate. Not until three months after the beginning of treatment did transillumination reveal a shadow in the temporal part of the globe, corresponding to the center of the detachment. A diagnostic puncture was made and melanoma cells found in the subretinal fluid. The diagnosis of malignant melanoma was confirmed in the enucleated eye. It is pointed out that a positive transillumination test is not absolutely diagnostic, and reference is made to Meisner's case, in which histologic examination of the enucleated eye revealed that the transillumination shadow was caused by inflammatory changes in the sclera. (12 references) Ray K. Daily.

Straub, W. and Conrads, E. **Pupillary iris cysts following the use of miotics.** Acta Ophth. **33**:561-570, 1955.

The authors report nine cases of unilateral or bilateral cysts of the pupillary margin of the iris, which developed after the use of various miotics. In some cases the cysts were multiple. Their occurrence does not depend on the type of glaucoma, or the functional state of the eye; they may appear after a few weeks of instillation of miotics, and they may be single or multiple. They occur in eyes without surgery as well as in those with iridectomy. They are very delicate and rupture on touch or on touch of the adjacent iris, an occurrence common during an iridectomy. If the pupil is very narrow, they may impair visual acuity. They appear to have a predilection for the upper half of the pupil. Histologically, the cysts consist of one layer of pigment epithelium. Between the two walls of the cyst is an eosin staining substance, representing the remains of the fluid contents of the cyst. The attempt to produce cysts experimentally in four rabbits and six guinea pigs by instillation, for six months, of mintacol, pilocarpin, prostigmin or eserin failed to produce adequate miosis or cysts. (5 figures, 1 table, 7 references) Ray K. Daily.

Vedeneeva, V. **Essential atrophy of the iris with glaucoma.** Vestnik oftal. **5**:86-87, Sept.-Oct., 1956.

A woman, aged 37 years, saw rainbows before the right eye and had impaired vision in the left. The irises showed the typical picture of essential atrophy. The slitlamp examination showed that the iris was divided in two belts, the crypts and lacunes were indistinct. In the ciliary part the connective tissue layer was nearly absent, the pigment-muscular layer was markedly thinned, the pupils were normal. The increased ocular tension in the right eye was normalized with miotics, the left eye had cataract. The etiology was not established. Olga Sitchevska.

Woods, Alan C. **A further study of streptococcus vaccines in nongranulomatous uveitis.** A.M.A. Arch. Ophth. **56**:749-755, Nov., 1956.

In 1953, Woods discussed the diagnostic and therapeutic use of streptococcus vaccines in nongranulomatous uveitis. In this paper he reports 175 additional cases of uveitis and specific desensitization in 50 cases. There was a high incidence of hypersensitivity to stock and autogenous strains of streptococcus. Desensitization is recommended in severe cases and gives a large percentage of successful results. (6 tables, 2 references) G. S. Tyner.

9

GLAUCOMA AND OCULAR TENSION

Bunin, A. and Romanovsky, M. **A modified dark room tonometric test in early diagnosis of glaucoma** Vestnik. oftal. **5**: 19-22, Sept.-Oct., 1956.

The ocular tension is taken when the patient has been in good light and again

after he has been in a dark room for about an hour. For the second measurement the dark room is dimly illuminated with a small red light. Red monochromatic light is close to darkness in its action on the eye.

Among 55 patients sent to the Helmholtz Institute for suspected glaucoma, the increase of ocular tension of from 4 to 12 mm. occurred in 13 after being in the dark room; in one patient the increase was 23 mm. This modified dark room test was more sensitive than the ordinary dark room test in 10 patients.

Olga Sitchevska.

Colley, R. **Report on 104 cases of glaucoma operated upon by galvano-cautery puncture.** Brit. J. Ophth. **40**:436-438, July, 1956.

In five years, in all cases of gaucoma of whatever type at the Bath Infirmary, galvano-cautery puncture of Preziozi was done. Of 121 punctures done on 104 eyes, 54 were for chronic simple, 34 for acute or subacute and 33 for secondary glaucoma. A superior conjunctival flap was brought down over the cornea, after which an ordinary galvano-cautery at red heat was pushed through the limbus into the angle of the chamber, purposely burning the iris at that point to prevent prolapse. The opening should be large enough to admit an iris repositor. The conjunctival flap was then closed. In chronic glaucoma the operation had to be repeated in five cases; there were three failures and the percentage of success was 93.87. The same results were obtained in the acute cases and the results in secondary glaucoma were almost as dramatic especially in glaucoma secondary to uveitis. The general and more widespread use of the procedure is urged. (2 references)

Morris Kaplan.

Törnquist, Ragnar. **Chamber depth in primary acute glaucoma.** Brit. J. Ophth. **40**:421-429, July, 1956.

By use of Stenstrom's apparatus, various measurements of the depth of the anterior chamber were made of 146 affected eyes in 95 patients with acute primary glaucoma. Ten readings were made on each eye to obtain a true axial depth which in the average normal measures about 3.0 mm. Many of the eyes had undergone surgery and many were under influence of miotics; neither seemed to cause much permanent change in chamber depth. After iridectomy the depth is increased for a few days but promptly returns to its previous measure. In these eyes, the chamber measured 1.70 mm. in males and 1.63 mm. in females which was about two thirds of normal. In patients with bilateral acute glaucoma the two chambers measured about the same whereas in uniocular disease, the affected eye showed an appreciably shallower chamber. (2 figures, 10 tabes, 6 references)

Morris Kaplan.

Vilmar, K. F. **The pressure-regulating effect of iridencleisis.** Ophthalmologica **132**:48-56, July, 1956.

The basis of the report is a series of 214 iridencleisis operations performed on 74 eyes with chronic simple, 90 eyes with chronic inflammatory, 31 eyes with acute inflammatory, 19 eyes with secondary and 5 eyes with congenital glaucoma. Four techniques were used: 1. oblique keratome incisions parallel to the iris plane, with incarceration of (1a) one peripheral iris tongue or of (2a) two full-radius pilars; and 2. ab externo incision at a right angle to the surface of the globe with incarceration of (2a) either one iris tongue or (2b) two full-radius pillars.

By gonioscopic examination the inner aperture of the incision proved to be located, on the average, further forward into the cornea in the cases operated on by technique 1. This inner aperture was found to gape visibly in most of the tension-normalized cases ("Sickerspalt").

The highest percentage of regulation of tension was obtained by technique 2b, that is ab externo-incision at a right angle to the surface of the globe combined with incarceration of two iris pillars. The "ideal" position of the inner aperture of the incision is between the canal of Schlemm and the line of Schwalbe. The proper width of the permanent gap in the incision is best produced by incarcerations containing double thicknesses of iris.

Peter C. Kronfeld.

10

CRYSTALLINE LENS

Albers, Edward C. **Problems of cataract surgery with a round pupil.** Illinois M.J. **110**:124-128, Sept., 1956.

A method of cataract extraction practical for use in a small general hospital is described. Eight cases are reported to illustrate complications and steps taken to prevent them. The chief emphasis is on the desirability of a round pupil. Albers uses three corneoscleral sutures, a limbus-based flap, peripheral iridotomy, and tumbling with an erisophake. (6 figures, 2 references) Paul W. Miles.

Chrizshniakova, I. **The development of cataract in experimental diabetes.** Vestnik oftal. **5**:58-61, Sept.-Oct., 1956.

Experiments were done on 100 white rats; a 5-percent solution of alloxan was given by subcutaneous injection in the proportion of 100 cc. to one kilogram of the body weight. In 36 of the animals permanent symptoms of diabetes were obtained. These animals' eyes and also those of the control eyes were examined by slit-lamp microscopy. Incipient opacities of the lens appeared between the 11th and 53rd day. The types and stages of the development of the cataract and the pathologic picture of the enucleated eyes are described in detail.

In experimental diabetes, caused by alloxan, bilateral cataracts were observed in white rats, from the 11th to the 53rd day. In some animals, there were only spot-like opacities, in others opacities were multiple; the development gradually progressed and on about the 66th to the 118th day there were fully developed cataracts. The cataracts were of the subcapsular-cortical type; at first only the subcapsular layers were affected, but later on all the cortical layers became opaque. There was an inflammatory process in the anterior uveal tract in the rats with an alloxan diabetes. These changes progressed and often ended in formation of synechia with atrophy of the iris and ciliary body.

Olga Sitchevska.

Cordes, Frederick C. **Failure in congenital cataract surgery: a study of fifty-six enucleated eyes.** Tr. Am. Acad. Ophth. **60**:345-367, May-June, 1956.

In a very searching study, the author has come to some practical conclusions after pathologic examination. He suggests that linear extraction is the safest operation for congenital cataract; full iridectomy should be performed where preoperative pupillary dilatation was impossible; where linear extraction is contraindicated, the procedure to be chosen should be one which will do the least damage to the vitreous and thus the retina; multiple needlings seem to be the least desirable since the incidence of late retinal detachment is greatest. (14 figures, 6 tables, 19 references) Theodore M. Shapira.

Dunnington, John H. **Ocular wound healing with particular reference to the cataract incision.** A.M.A. Arch. Ophth. **56**:639-659, Nov., 1956.

This article is the Bowman lecture for 1955. The author discusses many phases of normal and abnormal healing and response to drugs. He stresses the slowness with which the posterior part of a cataract incision becomes thoroughly

healed, and the respones of tissue to both absorable and nonabsorbable sutures. Shallow anterior chamber was present in 13 percent of 800 cataract extractions and was not affected by diamox. Corneoscleral sutures have greatly reduced the complications which result from gross imperfections in wound healing, but have not materially altered the incidence of tissue incarceration and epithelial invasion of the anterior chamber. (7 figures, 111 references) G. S. Tyner.

Glezerov, S. **Cataract in intoxication with nitro dye.** Vestnik oftal. 5:46-49, Sept.-Oct., 1956.

In a number of workers in industries in which nitro dyes are used (machines, automobiles, furniture, leather) a special form of cataract was observed by the author. These people worked from 10 to 15 years before the changes in the lens developed at an average age of 40 to 50 years.

Study with the slitlamp showed the presence of a number of small whitish opaque spots in the cortex of the lens. These spots become denser and larger towards the equator, but in the lower nasal side they form a dense opacity in the shape of a semicircle. There is also a change to yellowish of the subcapsuar layers of the lens. Olga Sitchevska.

Shershevskaya, O. **The surgical treatment of the luxated and subluxated lens into the vitreous.** Vestnik oftal. 5:3-7, Sept.-Oct., 1956.

During the last three years, 26 patients (28) eyes were operated on for luxation and subluxation of the lens into the vitreous; in two patients, the luxation of the lens was bilateral. In 11 eyes, the lens was transparent. Secondary glaucoma was seen in 15 patients with high ocular tension and severe pain, and in 12 out of 17 patients with traumatic luxation, but in only 3 out of 11 spontaneous subluxations. In trauma, the subluxation of the lens was more pronounced than in the spontaneous ones. The traumatic luxations were the result of blunt injury to the eye. In three spontaneous subluxations the lenses were hypermature; in eight patients, the cause was unknown.

The surgical procedure consisted of an incision at the limbus with Graefe's knife after preplaced corneal sutures. In six patients, a conjunctival flap was used. The lens was removed with a loop in all eyes. The author stresses the importance of the correct introduction of the loop according to the position of the lens. In 19 patients, an intracapsular extraction was done, in 5 the capsule was torn. There was prolapse of the vitreous in 7 patients and in 4 it appeared in the anterior chamber.

The time of observation was from 10 months to two years. The visual results were good in 18 patients; there was no improvement in 4 patients with changes in the fundi. The ocular tension was normal after the operation. In two patients, the lens could not be extracted and an enucleation had to be done.

Shershevskaya emphasizes the importance of operation before secondary glaucoma occurs, which makes the operation difficult and hazardous. (2 tables)

Olga Sichevska.

Shoch, David. **Radiation cataract.** Illinois M. J. 110:14-15, July, 1956.

The author gives the general background of the problem of ionizing radiation injury to the eye and discusses the possible mechanisms for the formation of radiation cataracts. Generalized injury plays no part in the etiology of this condition. Experimental work by the author indicates that injury to the surrounding stuctures of the lens has only a minor effect on the lens damage. The best evidence to date indicates that the site of original injury is the lens epithelium. How the cataractous process progresses from this peripheral region to the posterior cap-

sular zone is still unknown. (13 references) David Shoch.

11
RETINA AND VITREOUS

Heck, Joachim. **The electroretinogram in closure of the central retinal artery.** Arch. f. Ophth. **158**:17-28, 1956.

In 22 patients electroretinograms were taken before, during, and after therapy. In a few cases the ERG was normal shortly after the onset of the occlusion but disappeared in a few hours. If the circulation is not reestablished very soon, the potentials disappear completely or at best remain at a very low level. Even when visual field and acuity improve greatly, a defect in the ERG remains permanently. There is a correlation between the last ERG and the recovery of field; the higher the potential the larger is the field.

Consideration of these findings, the results of experiments in animals, and histologic findings suggest that the ERG gives information chiefly about the bipolar cells. (8 figures, 1 tabe, 19 references) F. H. Haessler.

Huerkamp, B. **Frequency and etiologic meaning of corneal astigmatism in cases of retinal detachment, especially in ruptures of the ora serrata.** Arch. f. ophth. **157**:592-597, 1956.

In more than 1,000 cases with retinal detachment the author found an astigmatism of one or more diopters twice as often as in normal eyes. The coincidence of retinal detachment and corneal astigmatism is considered to have a common ontogenetic origin and is often also combined with myopia. (2 tables, 9 references) Ernst Schmerl.

Jean-Gallois. **Induced supravision: studies on arteriolocapillary physiopathology.** Presse Med. **64**:1528-1530, Sept. 22, 1956.

The authors feel that the prolonged administration of well known vasodilators such as nicotinic acid, priscoline, amylnitrite, and of such less well known substances as 1-percent potassium iodide, cyanide of mercury and gutamic acid, improve the function of the retinal capillary bed and thus cause an improvement in vision. Good results have supposedly been obtained in senile retinopathies, myopia, glaucoma and cataract. The authors wisely point out that there is probably no curative effect of these medications on the underlying pathologic process, but they feel that the improved visual acuity is the result of reactivation of inert capillaries. Unfortunately there is no systematic presentation of the vision in a large group of cases over a reasonable length of time and no attempt to evaluate the benefit from placebo administration in these patients. Objective evidence of vascular alterations in either the choroid or retina is also not presented. (22 references) David Shoch.

Karpe, G. and Uchermann, A. **The clinical electroretinogram in circulatory disturbances of the retina.** Acta. Ophth. **33**: 493-516, 1955.

The material for this study comprises 88 eyes of 82 patients. The electroretinogram in 16 eyes with embolism of the central retinal artery was extinguished, indicating a poor prognosis as to vision. In seven cases with embolism in a branch of the retinal artery, the electroretinogram was not changed significantly, being normal or subnormal, depending on the extent of the retinal damage. In these cases the functional prognosis is good. In 39 eyes with thrombosis of the central retinal vein the electroretinogram varied from normal to the extinguished; the visual acuity after healing corresponded to the type of electroretinogram; in the cases in which the electroretinogram at the outset was normal or supernormal, the final visual acuity

was good. In the cases in which the electroretinogram was extinguished, the visual acuity was poor. The same is true of thrombosis of a branch of the central retinal vein in 26 eyes. The tabulated data of 84 eyes relate to the age of the patient, duration of the symptoms, the electroretinogram in the affected and the normal eye, visual acuity, fundus changes and the general blood pressure. (6 electroretinographs, 4 tables, 19 references)

Ray K. Daily.

Kornerup, Tore. **Capillary fragility and diabetic retinopathy.** Acta Ophth. **33**:583-598, 1955.

The literature is reviewed, and the results of the author's own investigation reported. Gothlin's petechial index was determined in 376 diabetics. Diabetic retinopathy was present in 38.4 percent, and hypertensive vascular disease was present in 29.5 percent of the cases. It was found that the petechial index increases with age in diabetics as well as in nondiabetics, and in every age group with the duration of the diabetes. It increases also with the severity of the retinopathy, and with the degree of hypertensive vascular disease. It is believed that in diabetics the increased petechial index may be caused by the specific disease of the venules, which results in the retinopathy and renal disease, and by the hypertensive fundus changes. The contradictory and confusing results reported from therapy with rutin and allied substances is explained by this double etiologic cause of the increased petechial index. In cases with retinopathy, the increased petechial index may be caused by the hypertensive vascular lesions; even if the petechial index is influenced favorably by the administration of rutin the retinopathy persists because it is independent of the hypertensive vascular disease. (8 tables, 70 references)

Ray K. Daily.

Malkin, A. **The ophthalmoscopic examination of the vessels of the fovea.** Vestnik oftal. **5**:84-85, Sept.-Oct., 1956.

The examination of the vessels of the fovea was done by direct ophthalmoscopy on 200 patients, of whom 50 had pathologic changes of the fundus. Branches of the upper and lower arterioles and venules of the retina and also macular branches from the optic disc go beyond the macular reflex and stop abruptly at the foveolar reflex. Only the foveola has no vessels. There were 12 to 14 vascular branches at the periphery of the fovea.

In the 50 patients with abnormality in the fundus, there were 25 eyes in which no vessels were observed in the macular region: in 10 eyes with hypertensive changes (edema of the macula), in 8 eyes with degenerative atrophic changes in the macula in high myopia, and in 3 eyes with tuberculous chorioretinitis involving the macular region. The author believes that the absence of vessels in the macular region indicates the pathologic condition of the retina previous to the appearance of abnormality in other parts of the retina.

Olga Sitchevska.

Renard, G., Saraux, H. and Vergez, A. **The ocular manifestations of malignant hemorrhagic dysglobulinemia.** Ophthalmologica **131**:157-163, March, 1956.

This rare blood dyscrasia is characterized by hyperproteinemia and specifically hyperglobulinemia, slight cytologic changes in the bone marrow and a marked hemorrhagic tendency. The eyegrounds show a picture resembling leukemia, and characterized by multiple retinal hemorrhages with marked tortuosity and engorgement of the veins. Two cases of this rare disease are reported in detail. (1 figure, 6 references) Peter C. Kronfeld.

Sachsenweger, R. **Functional defects in eyes with incipient senile macular lesions.** Arch. f. Ophth. **158**:8-16, 1956.

It is often difficult to distinguish ophthalmoscopically an early degeneration of the macula from a physiologic variant, but with the demonstration of microscotomata by means of polarization campimetry this distinction is easily made. The author records the findings in 15 illustrative patients. (2 figures, 1 table, 21 references)

F. H. Haessler.

Sourdille, G. P., Pasquier, M. and Grislain, J. R. **Retinopathy in the premature.** Sem. Hop. Paris **32**:2771-2778, Sept. 10-14, 1956.

Of 600 prematures seen at The Premature Center in Nantes, 330 weighed less than 2,000 gm. at birth and survived. In this group there were 13 cases of complete retrolental fibroplasia, 5 of partial fibroplasia and 38 in which the initial retinopathy receded completely. The study covers a period of five years (1951 to 1955). Most of the cases occurred in the first three years when oxygen therapy was freely given. In 1954 oxygen was used more carefully and only two cases of complete fibroplasia occurred. However, there were 12 cases which regressed completely. In 1955 the administration of oxygen was severely curtailed, and no case of RLF in any stage occurred.

The authors studied various prenatal, as well as postnatal, factors and conclude that in all probability excessive oxygen is the etiologic factor in this disease. (3 tables)

David Shoch.

Zozulia, L. **Pseudoalbuminuric retinitis in intracranial hypertension.** Vestnik oftal. **5**:34-37, Sept.-Oct., 1956.

The examination of 653 patients with hypertension syndrome showed pseudoalbuminuric retinitis and papilledema in 12 patients. The cause of increased intracranial pressure was intracranial tumor in five, infectious disease of the nervous system (arachnoiditis, meningo-encephalitis) in six and a tuberculoma in one. The age of the patients was from nine to 43 years. In all of them the kidney function was normal. In the majority of the patients there were retinal hemorrhages and a star-shaped figure in the macular region. These changes in the retina occurred with a slowly developing pathologic process in the brain (from 10 months to 2 years). The cause of the retinitis is not clear and is probably a pathologic change in the end capillaries of the retina due to increased intracranial pressure. (1 table)

Olga Sitchevska.

12

OPTIC NERVE AND CHIASM

Mollica, V. **Ethmoidal-sphenoidal sinusitis and retrobulbar optic neuritis.** Riv. oto-neuro-oftal. **31**:93-97, March-April, 1956.

The author discusses posterior sinusitis as an etiologic factor in retrobulbar optic neuritis. He evaluates 26 patients in whom such a situation was considered to exist. He expresses the opinion that treatment of the sinuses in such cases of retrobulbar neuritis may lead to improvement.

William C. Caccamise.

13

NEURO-OPHTHALMOLOGY

Cristini, G. **Pupillotonia due to ciliary ganglionitis.** Riv. oto-neuro-oftal. **31**:89-92, March-April, 1956.

The author presents two cases of pupillotonia. Both patients were women, one 49 years old, the other 22. In one patient biomicroscopy revealed a faint aqueous beam in the eye with the abnormal pupil. In both patients there was corneal hypesthesia. The author concludes that the pupillotonic syndrome (Adie's syndrome) is a manifestation of ciliary ganglionitis. (7 references)

William C. Caccamise.

ten Doesschate, G. and ten Doesschate, J. **Electronystagmography and steady po-**

tential of the eye. Pract. oto-rhino-laryng. **18**:306-307, Sept., 1956.

The source of electrical current in the electrooculogram or electronystagmogram is the potential difference between the cornea and the posterior pole of the eye. In the vertebrate the cornea is electrically positive with respect to the posterior pole. Since the steady potential arises from the retina and probably from the receptor rods and cones, dark (and light) adaptation should have some effect on this steady potential. The authors find this to be true. During dark adaptation the steady potential decreases to a minimum and this reaches an end value which is 90 per cent of the previous light-adapted value. This fact should be taken into account in electronystagmography and experimental conditions should be arranged so that there is no alteration in the state of adaptation of the eye during the experiment. (7 references) David Shoch.

Eurico Ferreira, L. and Alves Sampaio, H. **Horner's syndrome.** Rev. brasil. oftal. **15**:344-351, Sept., 1956.

The authors present a case of congenital Horner's syndrome and give a short historical summary of the literature on Horner's syndrome and mention especially the Brazilian papers. They describe the clinical picture of this syndrome, which is characterized by the classical triade of miosis, ptosis and enophthalmos, and often some other signs as well, such as decrease of the interpalpebral fissure, vasomotor disturbances, abnormal sweating, elevation of the inferior lid, heterochromia, cataract, hypotony, disturbances in the secretion of tears, and facial hemiatrophy.

Horner's syndrome as well as the Claude Bernard syndrome can be caused by any pathologic process in the sympathetic nerve anywhere in its course, and the exact localization determines what other disturbances may be present. (18 references) Walter Mayer.

Grönvall, H. and Silwer, H. **Intracranial tumors at the Central Hospital of Kristianstad, between 1940-1954.** Acta Ophth. **33**:599-614, 1955.

This is an analysis of 160 cases seen within this period. The incidence, history, symptoms, treatment, and prognosis are discussed. Patients with glioma were usually seen first by the internist; those with tumors at the base of the skull by the ophthalmologist, and others by the pediatrician, or otolaryngologist. In the 164 patients the visual pathway was intact in 37. Papilledema was a common accompaniment of glioma and meningioma not located basally, and of neurinoma, metastases and Lindau tumors; it was not encountered in hypophyseal tumors. Slow cerebration was found in 50 percent of patients with glioma and 76 percent of patients with glioblastoma multiforme. Papilledema was more frequent in infratentorial than in supratentorial tumors, but slow cerebration was equally frequent in both. X-rays of the skull aided in the diagnosis of three cases of glioma by revealing calcification of the tumor. Separation of the sutures and displacement of a calcification of a pineal body revealed an expanding process in 12 patients. Nine out of 12 cases of meningioma, and 17 out of 19 hypophyseal tumors were revealed by X-ray studies of the skull. Three craniopharyngiomas showed typical granular calcification, and seven out of 11 patients with neurinomas of the acoustic nerve showed a widening of the porus acusticus internus. X-ray films of the skull failed to reveal metastatic tumors, while X-ray films of the chest showed metastases in every case. X-ray study of the chest is indicated in cases of rapidly growing expanding intracranial processes. (5 figures, 10 tables) Ray K. Daily.

Hollenhorst, Robert W. **Neuro-ophthalmologic examination in children.** Neurology **6**:739-743, Oct., 1956.

In examining children's eyes for symptoms of neurological disease, one should determine the visual acuity, pupils, eye movements or weaknesses, eyelid movements, retinal and optic nerve condition, and visual fields. Visual fields in children under the age of eight often have lateralizing value, but seldom are localizing. The fluorescent test objects in a dark room are not recommended for testing visual fields because children, like 15 percent of adults, cannot keep central fixation. In the dark, the examiner cannot know whether the tested eye is fixing correctly. (3 references) Paul W. Miles.

Klingon, G. H. and Smith, W. M. **Raeder's paratrigeminal syndrome.** Neurology **6**:750-753, Oct., 1956.

Raeder described a "paratrigeminal syndrome" which included ocular sympathetic palsy with involvement of one or more cranial nerves. There was ptosis and miosis, but not anhidrosis. On the basis of findings in the case reported, the authors give several reasons for questioning Raeder's localization of the lesion in the paratrigeminal area, and his assumption of tumor as more likely than inflammation as a cause. The authors advise arteriography and air studies only in patients in whom the symptoms have increased gradually without signs of inflammatory disease and multiple foci. (3 figures, 4 references) Paul W. Miles.

Kuilman, J. **Vestibular nystagmus and counter-rotation of the eyes recorded simultaneously.** Pract. oto-rhino-laryng. **18**: 287-293, Sept., 1956.

A device is presented to record horizontal and rotary nystagmus simultaneously. It consists essentially of a small silk contact lens to which is attached a fine platinum needle with a small ball at its termination. This records the horizontal movements of the eye. A second fine needle is affixed to the first at right angles to it, and this records the rotary movements of the eye. A special table is used so that the position of the patient may be altered rapidly. The author feels that this optical method is more advantageous than electrical recording devices for separating horizontal and rotary movements and studying their relationships. (2 figures, 3 references) David Shoch.

Lansberg, M. P. **Possible errors in electronystagmography.** Pract. oto-rhino-laryng. **18**:294-296, Sept., 1956.

The author succinctly presents the sources of error in electrical recording of nystagmus. He mentions the source of energy (corneal-retinal potential), the leads, the apparatus, the direction of gaze and the amplitude of excursions. The most important of these is apparently the direction of gaze. The other factors can be minimized by regular calibration at frequent intervals during a recording. This should best be done with the eyes open in darkness and with the plane of calibration the same as the plane of nystagmus. (5 references) David Shoch.

Loewenfeld, Irene E. **Registration of the pupillary motility and the nervous regulation of the pupillary reflexes.** Arch. f. Ophth. **157**:628-655, 1956.

This paper disputes Cueppers' arguments against Lowenstein's pupillographic procedures. Most of the papers by Lowenstein and by Cueppers are abstracted in this journal. Since the procedures and instruments are highly specialized, the average reader has to accept what is presented in the present study. However, this abstractor would like to state his impression that the defense of Lowenstein's procedures is convincing. (17 figures, 27 references) Ernst Schmerl.

Lyle, Donald J. **Neuro-ophthalmology.** A.M.A. Arch. Ophth. **56**:768-789, Nov., 1956.

This excellent and complete review of neuro-ophthalmology covers the literature of the 12-month period ending July, 1956. (202 references) G. S. Tyner.

Martelli, A. **The syndrome of Foster Kennedy of vascular etiology.** Riv. oto-neuro-oftal. **30**:487-502, Nov.-Dec., 1955.

The author reviews the literature and the classical signs found in Foster Kennedy syndrome. He then describes in detail a 68-year-old man with optic atrophy in the left eye and papilledema in the right eye. Angiography revealed carotid arteriosclerotic changes. Craniotomy verified the angiographic interpretation. (5 figures, 1 table, 16 references)

William C. Caccamise.

Perez Llorca J. and Lopez-Porrua, J. M. **Binasal hemianopsia in optochiasmatic arachnoiditis.** Arch. Soc. oftal. hispano-am. **16**:479-498, May, 1956.

This is a comprehensive review of the literature on the etiology and pathogenesis of binasal hemianopsia, with special emphasis on that produced by optochiasmatic arachnoiditis. The author adds another case to the 16, verified surgically and histologically, reported in the literature. The patient, 21 years old, lost visual acuity in both eyes in the course of one year. Binasal hemianopsia, optic atrophy and a central scotoma for 3 mm. were the ocular findings. The patient had a right chronic purulent otitis, for which he had had surgery previously. The diagnosis of otogenous basal optochiasmatic arachnoiditis was made and the optochiasmatic region explored surgically through a right frontal craniotomy. The cistern over the anterior cranial fossa was found distended, and opening it was followed by the evacuation of a large quantity of cerebrospinal fluid. An intricate network of adhesions bound the optic nerves and the chiasm. The adhesions were separated. When the patient regained consciousness, he said that he could see better and clearer. Three weeks after the operation he could count fingers with the right eye at two meters, and with the left at two and a half. The visual field extended well into the nasal portion and the central scotoma was absent. (11 illustrations, 36 references)

Ray K. Daily.

Selby, G. **Parietal lobe syndromes.** Ann. Australasian Med. **5**:89, 1956.

"Parietal lobe syndromes" cannot be taken as anatomically accurate but include symptoms of disease only predominantly involving the arbitrary boundaries of the parietal lobe and not infrequently extending into the posterior temporal and occipital regions.

This interesting paper presents in detail patients with lesions of the dominant hemisphere, the subordinate or of both. The neurological features are clearly described. Visual phenomena include hallucinations, homonymous field defects, metamorphopsia, and visual perseveration.

Ronald F. Lowe.

Simpson, Derek G. **Marcus Gunn phenomenon following squint and ptosis surgery.** A.M.A. Arch. Ophth. **56**:743-748, Nov., 1956.

The Marcus Gunn phenomenon has been inaccurately called the jaw-winking phenomenon inasmuch as it is not a wink but a lid retraction. The literature on the condition is followed by a case report of a young woman with no history of jaw winking in her family or herself who developed the syndrome after surgery for strabismus and ptosis. (3 figures, 36 references) G. S. Tyner.

Stephenson, R. W. **Paralysis of accommodation.** Tr. Ophth. Soc. U. Kingdom **75**:623-626, 1955.

Paralysis of accommodation was found in three patients after influenza, in three with disseminated sclerosis and in six in whom the etiology was not determined. In two of the latter the disturbance may have been congenital or associated with poliomyelitis, diphtheria or the use of hypotensive drugs. Beulah Cushman.

14

EYEBALL, ORBIT, SINUSES

Clausen, A. **Ophthalmologic observations in pulsating exophthalmos.** Klin. Monatsbl. f. Augenh. **129**:169-177, 1956.

Six cases are reported and the carotid (common or internal) was ligated in four. Two patients were treated conservatively. In one patient the exophthalmus occurred on the opposite side of the fistula. Two patients with a "spurious" pulsating exophthalmus are mentioned. One had a highly vascularized orbital tumor and the other a ruptured aneurysm of the internal carotid artery outside of the cavernous sinus. (21 references)

Frederick C. Blodi.

Collins, J. B. **The influence of characteristics of a fluctuating visual stimulus on flicker sensation.** Ophthalmologica **131**: 83-104, Feb., 1956.

The phenomenon under study is the sensation of flicker elicited in some people by fluorescent lighting. In certain industries the phenomenon can be a disturbing factor of considerable magnitude.

A systematic study has been made of the factors that influence the flicker sensation elicited by intermittent stimuli. The factors specifically investigated were the size of the stimulus area in relation to the visual field, the luminance of the stimulus area and the wave-form and frequency of the stimulus. From the observations made on 20 normal subjects the author concludes that the normal 100 cycle/second fluctuation of light from a fluorescent lamp will probably give rise to a negligible incidence of flicker at the usual brightness level. Flicker occurring under these circumstances is probably due to the presence of a small subharmonic component in the light output wave. At high levels of fluorescent illumination a very much greater incidence of complaints about flicker is to be expected. (15 figures, 3 tables, 8 references) Peter C. Kronfeld.

Foster, John. **The analysis and treatment of diplopia due to orbital trauma by the Lancaster test.** Tr. Ophth. Soc. Australia **15**:159-161, 1955.

The following are described very briefly: penetrating injuries, operative frontal bone injuries, accidental frontal fracture and Malar fractures.

Ronald F. Lowe.

Foster, John. **The diagnosis and treatment of orbital tumors.** Tr. Ophth. Soc. Australia **15**:186-189, 1955.

Symptoms, investigation, topical syndromes, correlation of data, and operation are described in a very brief paper.

Ronald F. Lowe.

François, J. Rabaey, M. and Evens, L. **Chronic orbital myositis.** Ophthalmologica **131**:105-120, Feb., 1956.

In three cases of slowly progressive unilateral proptosis, orbital neoplasms were suspected and exenterations performed. Histologic examination revealed chronic myositis, affecting one or several ocular muscles. Well-organized lymphocytic follicles had established themselves within the muscle and caused degeneration and atrophy of the muscle fibers. The surrounding orbital tissues participated in the infiltrative process to a very slight degree. The histologic picture was characteristic, but not suggestive of any specific etiology. In only one case was the orbital disease preceded by a short period of thyrotoxicosis. (12 figures, 24 references) Peter C. Kronfeld.

Fry, W. E., Rose, E., Jefferies, W. McK. and Henderson, J. W. **Symposium: Management of exophthalmos.** A.M.A. Arch. Ophth. **56**:660-684, Nov., 1956.

Fry, W. E. **Exophthalmos due to pathology in the orbit or adjacent structures.** pp. 660-667.

An ophthalmic pathologist discusses exophthalmos under the headings: inflammatory conditions of the orbit, vascular lesions, primary and metastatic tumors of the orbit, and conditions secondary to primary disease elsewhere.

Rose, Edward. **Endocrine aspects of exophthalmos.** pp. 668-670.

Rose deals primarily with thyrotoxic and thyrotropic exophthalmos. (6 references)

Jefferies, W. McK. **Treatment of exophthalmos from the viewpoint of an internist.** pp. 671-677.

Endocrine exophthalmos is discussed under the headings: stress, pituitary dysfunction, thyroid dysfunction, and an increased amount of fluid in the orbital tissues. Treatment is considered under the headings of general supportive measures, local management of eye symptoms, treatment of thyroid dysfunction, the steroids, irradiation, and orbital decompression. (49 references)

Henderson, J. W. **Treatment of exophthalmos from the ophthalmologist's viewpoint.** pp. 678-684.

Duke-Elder lists 70 distinct causes of exophthalmos. The author, however, says he tries to place each case in the category of inflammatory, vascular anomaly, metabolic abnormality, or tumor. His surgical approach and techniques are discussed. (4 figures, 2 tables)

G. S. Tyner.

Gross, Heinrich. **Hypertelorism.** Ophthalmologica **131**:137-156, March, 1956.

Four cases of ocular hypertelorism (abnormally wide separation of the eyes in horizontal direction) are reported. The orbital anomaly was in each case associated with other more severe developmental anomalies namely, in case one and two with median facial clefts, in case two with agenesis of the corpus callosum and olfactory lobe, in case three with maldevelopment of the urogenital system and in case four with mandibulofacial dysostosis. This series characterizes hypertelorism as a conspicuous but mild symptom of wide-spread, very variable and usually very serious developmental anomalies. (7 figures, 32 references)

Peter C. Kronfeld.

Jackson, Arnold S. **Restoration of vision in a case of progressive exophthalmos.** Am. J. Surg. **92**:466-468, Sept., 1956.

The patient had had a thyroidectomy 25 years ago for hyperthyroidism and exophthalmic goiter. Sixteen years later hyperthyroidism recurred and was again relieved by surgery. After an automobile accident, his metabolic rate increased, adenomatous nodules appeared, and his eyesight failed to the point of blindness. He again developed hyperthyroidism. With thyroid therapy, his exophthalmos disappeared, his eyesight returned and the adenomas were reduced in size.

Irwin E. Gaynon.

Jackson, Harvey. **Conservation of the eyeball in the treatment of certain tumors of the orbit.** Tr. Ophth. Soc. U. Kingdom **75**:531-539, 1955.

The author discusses the patients with proptosis he had seen in 20 years and the results of treatment. A glioma of the optic nerve was removed in two patients and the eyeballs appeared quite normal with quite normal motility after 20 years. Removal of tumors of the optic nerve and malignant tumors of the orbit without removal of the eye is indicated in children in whom a short history and poor prognosis are particular features. In adults over 65 years of age the history of the

disorder is usually longer and the prognosis not so sinister. Radical surgical procedures have disadvantages; wide exposure of tissue spaces may encourage implantation of neoplasm in the wound tracks. Deep X-ray therapy does not mean destruction of the eye, either functional or structural during the course of the attendant disease. (4 figures)

Beulah Cushman.

Lehnert, W. **Enophthalmos in Horner's syndrome.** Klin. Monatsbl. f. Augenh. **129**:177-183, 1956.

In 120 patients a stellate gangion block was given and the exophthalmus measured before and after the injection. The second measurement was done when miosis and ptosis were marked. Not a single instance of unequivocal enophthalmus could be observed. The results varied a great deal and only in five patients was there a small degree of enophthalmus after the injection. (39 references)

Frederick C. Blodi.

Lemoine, Albert N., Jr. **The orbit.** A.M.A. Arch. Ophth. **56**:473-479, Sept., 1956.

This review contains mostly case reports, and descriptions of methods of examination, and of a few new surgical procedures. Apparently there is little basic research at present in this field. (52 references)

G. S. Tyner.

Rebello Machado, N. **Primary tumors of the orbit.** Rev. brasil. oftal. **15**:221-340, Sept., 1956.

The author oulines 1. the several procedures employed in the diagnosis of orbital tumors and 2. the differential diagnosis of diseases capable of causing unilateral exophthalmos and pseudotumors of the orbit. He reports a case of cholesteatoma, of neurofibroma, of neurinoma of the internal frontal nerve, of chloroma, one of meningioma and two cases of undifferentiated sarcoma of the orbit. Each one is reported extensively with history, physical findings, course, operative procedure and pathological report. The author also discusses the different types of treatment, surgery, X-ray and radium therapy, electrotherapy and the use of several drugs. (86 figures, 41 references)

Walter Mayer.

Rudzit, S. **Unilateral exophthalmos cured by extraction of tooth.** Vestnik oftal. **4**:39-40, July-Aug., 1956.

A woman, aged 28 years, had headaches on the left side, impairment of vision in the left eye and proptosis of five years duration (the left eye protruded 8 mm. more than the right) which started about the same time as tuberculosis of the lungs. The latter became quiescent under treatment, but the exophthalmos slowly progressed.

The vision was reduced to 0.7 and there was moderate papilledema. The motility of the eyeball was normal. The basal metabolism was increased but slightly. The fifth upper tooth was displaced and there was gingivitis about the fourth, fifth and sixth teeth. Thyriotoxicosis was eliminated and the fifth tooth was extracted. In two days the exophthalmos decreased to 3.5 mm. and soon after the edema of the disc subsided and the vision returned to normal.

Olga Sitchevska.

Shionuma, E. **A study of orbital neuralgia in leprosy.** Acta Soc. Ophth. Japan **60**:1069-1079, Aug., 1956.

Orbital neuralgia was observed in 95 cases of leprosy in a leprosarium. The supraorbital nerve is predominantly affected. This condition is chiefly found in long-lasting cases of over ten years. A removal of the nerve can cure the condition. Histologically, there is a leprous interstitial neuritis. (7 figures, 59 references)

Yukihiko Mitsui.

Tayebi, H. and Silverman, F. N. **Congenital defect of the bony orbit and pulsating exophthalmos.** A.M.A. J. Dis. Child. **92**:138-146, Aug., 1956.

Two cases are described. One was noted at the age of two months, and was associated with a local neurofibromatosis; the other at the age of five years without apparent cause. The literature on both the anterior and the posterior type of congenital defect of the bony orbit is reviewed. The pulsation often arises because the brain tissue is not covered by bone. The details of the radiographic appearance are given. A differential diagnosis is presented covering arterio-venous fistula, xanthomatosis, dermoid and epidermoid tumors of the orbit, surgical defects and traumatic defects. (6 figures, 25 references) Harry Horwich.

15

EYELIDS, LACRIMAL APPARATUS

Damato, F. J. **Congenital fistula of the lacrimal gland.** Brit. J. Ophth. **40**:506-508, Aug., 1956.

This case is not only rare but is also the first in which the orifice is lateral to the external canthus. In the ten previously recorded cases all the fistulas were somewhere in the upper lid, usually near the upper portion of the tarsus. The orifice was very small, about 1 mm., and could only be seen when tears emerged from it when the infant cried. No treatment is described. (6 figures, 7 references)
Lawrence L. Garner.

Gault, Adelaide. **Epiphora and the silver style.** Tr. Ophth. Soc. Australia **15**:122-127, 1955.

The silver style is a useful instrument for pure obstruction of the lachrymal canal. Under general anaesthesia the canal is dilated with probes, the canaliculus slit and the style introduced. It is moved up and down twice a week while it is retained for three months after which time the canal is patent and epithelialised. (3 figures) Ronald F. Lowe.

Jones, Barrie R. **Clinical features and etiology of dacryoadenitis.** Tr. Ophth. Soc. U. Kingdom **75**:435-452, 1955.

The author describes 16 cases of dacryoadenitis of various etiology (six staphylococcal; three Dunedin infectious mononucleosis with negative Paul-Bunnell; one with a positive Paul-Bunnell; three acute dacryoadenitis with lymph adenopathy and eosinophilia; one undetermined etiology; one orbital dacryoadenitis in which mumps could not be excluded; one gummatous dacryoadenitis). In dacryoadenitis it is always important to assess the patient as a whole. (8 figures, 4 tables, 19 references)
Beulah Cushman.

Jones, Barrie R. **Lacrimal disease associated with infectious mononucleosis.** Tr. Ophth. Soc. U. Kingdom **75**:101-119, 1955.

Four patients with infectious mononucleosis who developed lacrimal disease are described. The ocular manifestation of the systemic illness became apparent only after repeated general physical examinations and blood studies. No specific treatment was found. (9 figures, 3 tables, 30 references) Beulah Cushman.

Kisin, P. **The functional relationship between the upper tarsal muscle and the levator.** Vestnik oftal. **1**:19-22, Jan.-Feb., 1956.

Kisin expresses the opinion (based on previous work and on clinical data) that the upper tarsal muscle has no independent function because its strength is insufficient. Contraction of this muscle stretches the levator and irritates its sensory elements, which brings about reflex contraction of the muscle (tarso-levator reflex). The pathogenesis of a paralytic ptosis can be explained as an interruption of the centrifugal course of

the tarso-levator reflex. Kisin's hypothesis outlines the process by which the sympathetic nerve stabilizes the width of the palpebral fissure under normal conditions and brings about changes in it with changes in its own tonus. The levator is the only dilator of the palpebral fissure and the upper tarsal muscle merely starts the contraction.

Solutions of adrenalin and cocaine can be used for differential diagnosis of sympathetic ptosis and ptosis due to paresis of the oculomotor nerve. (1 figure)

Olga Sitchevska.

Kreibig, Guillermo. **The treatment of palpebral epitheliomas.** Arch. Soc. oftal. hispano-am. **16**:343-347, March-April, 1956.

Kreibig divides palpebral malignancies into four groups: 1. those that are movable with the skin of the lids, 2. those which invade the tarsus, the palpebral border or the conjunctiva, 3. those which are fixed to the lacrimal sac and the periosteum, and 4. those which extend deeply into the orbit or invade the globe. The author advocates surgical excision of all palpebral malignancies by an ophthalmologist. Postoperative irradiation, when indicated, should be a cooperative procedure between the ophthalmologist and radiologist. Every palpebral epithelioma should be radically excised, 3 mm. beyond its macroscopic border. The size of the tumor is not of much significance. With the exception of malignant melanomas, the histologic structure is also not important; of greatest importance is the extent of invasion into the neighboring structures. The excised tumor should be studied in sections in all directions; if there is any doubt as to its complete removal, postoperative irradiation is indicated. Recurrences following irradiation should be treated surgically, further irradiation being used only as an adjunct to surgery. In epitheliomas with invasion of the globe or the orbit, the primary objective becomes the saving of the patient's life and Kreibig advocates exenteration of the orbit and the invaded sinuses, and postoperative irradiation. He justifies his championship of surgical excision by the following facts. Generally the results of irradiation of the palpebral epithelioma alone are difficult to determine. While the skin appears cured, biopsies of the cicatricial tissue frequently demonstrate islands of tumor tissue, which, years later, may become the starting point of a recurrence. As irradiation requires several sessions and a percentage of patients fail to complete the treatment. Surgical excision affords a complete removal of the tumor at one time, and a microscopic analysis as to the completeness of the removal. Irradiation therapy sometimes requires subsequent surgery, which is more difficult in cicatricial and previously irradiated tissue. A small number of epitheliomas are resistant to radiation; this cannot be determined from the clinical or histologic aspect of the tumor; irradiation used in such cases leads to unsatisfactory results, and the time lost in irradiation frequently leads to the need for much more destructive surgery than would have been required by a primary surgical procedure.

Ray K. Daily.

Parry, T. G. Wynne. **Different approach to the lacrimal sac area.** Brit. J. Ophth. **40**:434-435, July, 1956.

A modification of the usual lacrimal sac incision is described in which two horizontal, nasalward skin incisions are made at each end of the usual incision. A rectangular area of skin is elevated and laid over the nose. This gives a much larger area of exposure of the sac. (2 figures)

Morris Kaplan.

Singer, Roy R. **Eyelid coloboma with cutaneocorneal bridge.** A.M.A. Arch. Ophth. **56**:449-450, Sept., 1956.

A case of unilateral coloboma of the eyelid with a cutaneocorneal bridge is

reported and theories of pathogenesis are given. (2 figures, 3 references)

G. S. Tyner.

Sjögren, Henrik. **The lacrimal secretion in newborn premature and fully developed children.** Acta Ophth. **33**:557-560, 1955.

The literature is reviewed and the data of the author's own investigation reported in detail. The author's method of examination consisted of use of the Schirmer test with litmus paper, and irritation of the nose with a pencil for 2 minutes. The tabulated data show that in 13 percent of fully developed newborn infants there is an alacrimia; secretion exceeding 15 mm. of litmus paper is found in 35 percent. Alacrimia is found in 37 percent of premature infants. The causes of alacrimia are discussed, and the author sides with those who attribute it to immaturity of the lacrimal glands. (4 tables, 7 references) Ray K. Daily.

Straatsma, Bradley W. **Meibomian gland tumors.** A.M.A. Arch. Ophth. **56**: 71-93, July, 1956.

The embryology, histology, and morphology of the meibomian glands are described. The reported cases of tumor of the meibomian gland are summarized and the author adds a clinical description of 21 tumors of the gland which he has seen. The tumors are classified and criteria for diagnosis are described. Two main categories are listed, benign and malignant. Under benign tumors are listed hyperplasia, adenoma and hamartoma. The malignant types are carcinomas. Of the 21 cases reported 16 were carcinomas, 3 adenomas, 1 hyperplasia and 1 hamartoma. The malignant types have a predilection for females in the sixth decade and are almost equally distributed in the upper and lower lids. They are usually a yellowish, nodular, vascularized mass prone to ulceration and late cicatricial deformity. (28 figures, 47 references)

G. S. Tyner.

16

TUMORS

Blodi, Frederick C. **Unusual myogenic tumors around the eye.** A.M.A. Arch. Ophth. **56**:698-701, Nov., 1956.

Two case reports are given, one a granular-cell myoblastoma occurring in the brow, and a rhabdomyosarcoma of the orbit in a young girl. (2 figures, 10 references) G. S. Tyner.

Dunn, S. N. and Walsh, F. B. **Meningioma (dural endothelioma) of the optic nerve.** A.M.A. Arch. Ophth. **56**:702-707, Nov., 1956.

This case report is of an optic nerve meningioma observed in an 11-year-old child, and again 17 years later. Interesting features of the case are the slow growth, absence of limitation of ocular movements and proptosis with proven intraorbital tumor, enlargement of the optic canal, and invasion of the optic nerve and the eye. (5 figures, 11 references) G. S. Tyner.

Newell, Frank W. **Diktyoma of the ciliary body.** Tr. Am. Acad. Ophth. **60**:406-412, May-June, 1956.

This neoplasm in the eye of a eight-months-old child presented an interesting clinical problem. The histopathologic findings are clearly shown in excellent photomicrographs. (7 figures, 9 references)

Theodore M. Shapira.

17

INJURIES

Andresen, E., Lebedinskaya, E. and Rivkina, E. **The prophylaxis of adhesions after burns of the eyeball and the lids.** Vestnik oftal. **5**:22-25, Sept.-Oct., 1956.

A celluloid plate, 0.14 mm. thick, curved to fit the anterior segment of the eye, was used in the Leningrad Traumatologic Institute in fresh burns. The plate was made from a roentgen film. A round hole about 10 mm. was cut in the center through

which medication was applied and the cornea could be observed. The edges of the plate reached the fornices of the conjunctiva. The plates were worn by the patients without complaint, probably because of lowered sensitivity of the eyeball after burns.

The celluloid plate was used on 29 patients; of these seven had a mild burn, thirteen a second degree burn, and seven had a severe burn with alkali, with deep necrosis of the cornea and conjunctiva. Two patients had old burns with adhesions; the adhesions were separated and transplantation of mucous membrane was resorted to before applying the plate. The celluloid plate should be kept for a long time (from 30 to 60 days) in severe alkali burns. Olga Sitchevska.

Golubitzkaya, N. **Subluxation of the lens in chalcosis of the eye.** Vestnik oftal. **5**:65-68, Sept.-Oct., 1956.

The clinical picture of the presence of copper in the eye is described in detail. During the years 1950 to 1953, 130 cases with intraocular foreign body were seen in the Kursk Eye Clinic; in 11 of these (8.5 percent) copper fragments were found in the eye. A typical picture of chalcosis was observed in seven patients. In four patients the chemical nature of the foreign body was confirmed by the analysis of the aqueous. In one patient with no light perception, there was an organized exudate in the vitreous. In five patients subluxation of the lens was observed three to nine years after the injury and in two patients, chalcosis of the retina—a rare finding.

The case of a boy, aged 9 years, is reported in whom the right eye was enucleated five years previously after an injury of the eye with a percussion cap shattered by an explosion. There was no suspicion of the presence of a foreign body in the second eye at the time of the injury. The cornea of the left eye showed a greenish color reflected from the posterior surface. The lens had the typical sun-flower cataract. The viterous showed greenish fibrils. The perimacular region had a ring of shiny golden punctate inclusions. The roentgenogram showed no foreign body. The vision was 0.5, which improved under treatment to 0.7. On the second and third admissions of the child, 6 months later, there was a full-blown iridocyclitis and the vision was reduced to finger counting; at this time subluxation of the lens into the vitreous was observed (5 years after the injury). The second similar case in a man, aged 21 years, with bilateral eye injury is described.

The subluxation of the lens is a result of the chemical action of the alloy of copper on the ligament of Zinn. The latter evidently resists the chemical action of copper for a long time; this explains the late appearance of the subluxation of the lens. Olga Sitchevska.

Gundorova, P. **Injury of the eye with hairs of a caterpillar.** Vestnik. oftal. **5**:39-40, Sept.-Oct., 1956.

The author reports a case of severe iridocyclitis with final loss of vision after an injury with hairs of a caterpillar. About 12 hairs were seen on the surface of the cornea which gradually penetrated into the iris and vitreous, with formation of exudates around them; two hairs were seen in the capsule of the lens which became cataractous; the vitreous had become opaque previous to this. The toxic infuence of formic acid present in the hairs presumably produced this pathologic process in the eye. Olga Sitchevska.

Jonquères, J. and de Saint-Martin, P. **Chorioretinal manifestations in electrocutions.** Arch. d'opht. **16**:397-403, June, 1956.

The authors note that lesions of the anterior segment and of the lens are common in electrical accidents but that lesions of the posterior segment are rare. They report a case of a high tension accident in which third-degree burns involved

the face, neck, arms, and hands predominantly. Because of mental symptoms the patient was under psychiatric care for a period of three months during which ophthalmoscopic examination showed normal anterior segments but important lesions of the optic nerves and of the choroid and retina, leading to a vision of light perception only in the right eye and 6/10 in the left. The lesion appeared to be vascular in origin and the abundant hemorrhages and exudates followed the retinal vessels. Three drawings in color illustrate the fundus changes.

P. Thygeson.

Pesce, Girolamo. **Evaluation of visual function in industrial injuries.** Gior. ital. oftal. **9**:141-189, Jan.-Feb., 1956.

In a full and most interesting article the author reviews the principles of assessment of visual damage in injuries. Great stress is laid on the loss of visual acuity after all remedial procedures have been carried out. The author proposes a personal formula for the assessment of ocular damage, which he claims to be simple and which establishes the degree of compensation in relation to the visual loss. (5 tables, 49 references) V. Tabone.

Thomas, D. L. G. and Stiebris, K. **Vanadiium poisoning in industry.** M. J. Australia **1**:607, April 15, 1956.

Vanadium is present in all fuel oils and in the dust which lines combustion chambers of oil furances. Workers who clean these furnaces should have efficient ventilation and wear gauntlet gloves, high boots, overalls with tight fitting bands at the neck, wrists and ankles and respirators. The signs and symptoms of vanadium poisoning are irritation of the mucous membrane of the nose, throat and conjunctiva, greenish-black discoloration of the tongue, anemia, cough, rhinorrhexia, digestive and renal disturbances, trembling, headaches, psychic derangement and even blindness. Ronald F. Lowe.

18

SYSTEMIC DISEASE AND PARASITES

Bennett, George. **Cortisone therapy of visual loss in temporal arteritis.** Brit. J. Ophth. **40**:430-433, July, 1956.

In cases of temporal arteritis 40 to 50 percent of patients have abnormality of the eyes and 15 to 25 percent total blindness. To the cases previously reported, six are added in which treatment with cortisone was used. In three cases both eyes were affected but all received 150 mg. of cortisone daily for one week, then 100 mg. daily for one week. This regimen was followed by 50 mg. and then by 25 mg. as a maintenance dose. In all cases pain was stopped at once, but improvement of vision was slight. (2 tables, 19 references)

Morris Kaplan.

Fox, M. J. and Prier, T. A. **Congenital toxoplasmosis.** Am. Pract. & Dig. Treat. **7**:1817-1820, Nov., 1956.

The authors report two cases of toxoplasmosis and provide an excellent brief account of the important data of the natural history and clinical manifestations of the protozoan and its parasitic invasion of man. (3 figures, 7 references)

Irwin E. Gaynon.

Hamilton, J. Bruce. **Zoonoses in ophthalmology.** Tr. Ophth. Soc. Australia **15**: 72-86, 1955.

Zoonoses found in Australasia and accompanied by ocular complications are outlined. The subjects include toxoplasmosis, Newcastle disease, cat-scratch fever, Molluscum contagiosum, "Q" fever, leptospirosis, brucellosis, bovine tuberculosis, hydatids, trichinosis and scrub typhus. (2 tables, 106 references)

Ronald F. Lowe.

Kaminskaya-Pavlova. **Toxoplasmosis of the eye.** Vestnik. oftal. **5**:40-43, Sept.-Oct., 1956.

This is a detailed review of the literature on toxoplasmosis, its etiology, clini-

cal and pathologic findings, experimental toxoplasmosis of the eye, the diagnosis according to Sabin's and Feldman's method, the skin reaction and the method of complement fixation. A large Russian and foreign bibliography is given.

Olga Sitchevska.

Maumenee, A. Edward. **Ocular lesions of nevoxanthoendothelioma (infantile xanthoma disseminatum).** Tr. Am. Acad. Ophth. **60**:400-405, May-June, 1956.

The case which is described and discussed ocurred in a four-months-old child. No organic lesions were found in routine pediatric examination other than those of the skin and the eye. (5 photomicrographs, 5 references) Theodore M. Shapira.

Minton, Joseph. **Ocular manifestations of general disease.** Tr. Ophth. Soc. U. Kingdom **75**:453-471, 1955.

A pictorial record of ocular manifestations in general disease showed a gumma of the upper lid and forehead; acute generalized pemphigus; ocular pemphigus with recurrent ulceration of mucous membranes of mouth, throat, nose and vulva, and ptosis; occlusions of the central artery of the retina during migraine; Horner's syndrome; proptosis from tumor of the optic nerve; Kinnier-Wilson's disease and cystinosis. (12 figures, 3 references)

Beulah Cushman.

Offret, G. and Godde-Jolly, D. **Aneurysms of the ophthalmic artery.** Arch. d'opht. **16**:388-396, June, 1956.

The authors report their observations on three cases of aneurysm of the ophthalmic artery. Two of the cases had fusiform dilatations of the artery and of the carotid as determined by surgical exploration. Both showed reduced vision, papilledema, and retinal hemorrhages and exudates. Visual fields in both cases were abnormal; in the first there was a temporal defect and in the second a central scotoma. In the third case the aneurysm was intraorbital and the diagnosis was made by arteriography. The affected eye showed a slight contraction of the peripheral field, most marked inferiorly. Surgical exploration confirmed the diagnosis. The authors review the scanty literature on the subject and describe seven reported cases. In five of the seven cases no etiology was determined but one of the remaining two was traumatic and the other inflammatory. Possibilities of treatment are discussed. P. Thygeson.

Sterger, S. and Novak, S. **The etiology of temporal arteritis.** Ophthalmologica **131**:164-167, March, 1956.

From the blood of an 87-year-old man with a typical case of temporal arteritis, the authors were able to grow a strain of streptococcus viridans which proved highly sensitive to sulfathiazole and to the tetracyclines. On aureomycin therapy the patient's general condition improved but not his vision. The authors consider temporal arteritis a manifestation of hypersensitivity to a bacterial antigen. (25 references) Peter C. Kronfeld.

19

CONGENITAL DEFORMITIES, HEREDITY

Ashdown Carr, T. E. **A case of congenital blindness.** Tr. Ophth. Soc. U. Kingdom **75**:647-652, 1955.

A child born in March, 1946, was first seen the following August at the age of five months with the history that "he did not see." There was no family history of eye defects and no consanguinity. An older sister was normal. No pupillary light reflexes were present and the fundi appeared normal under an anesthetic. Two months later the child was able to follow a light, although no pupillary light reflexes were present. The pupillary light reflexes were present at the age of three and a half years and at this time mental retardation was evident.

Beulah Cushman.

Costi, C. **Three new cases of Crouzon's disease.** Arch. Soc. oftal. hispano-am. **16**: 515-524, May, 1956.

The author reports three cases of this disease, and makes reference to another case which he reported in 1952. Of these three cases, two were brothers, and the history indicated that the paternal grandmother had a cranial malformation. The other was an isolated case. None of the author's cases had a history of hard labor, as is the case with many of the reported cases. Endocrine disturbances were not encountered in any of the families of the patients. In one case there was a decided hypercalcemia and hyperphosphoremia, which must have originated in a diencephalic disturbance, and which explains the rarefaction of the cranial bones. Exophthalmos and changes in the optic nerve were the most prominent of the ocular symptoms. In one case there was a frank optic atrophy, and the other two cases had optic neuritis which will probably terminate in an optic atrophy. (11 figures)

Ray K. Daily.

Crosca, A., Recupero, C. and Blandino, G. **Bone marrow, blood picture and radiologic and ocular findings in the phosphate lipoidosis of Nieman Pick.** La Pediatria **64**:797-831, 1956.

The authors review current etiologic and pathogenetic concepts and report two cases. The hematologic, roentgenologic, and ocular findings in two children, aged 7 and 9 months, are described. (5 figures, 59 references)

F. H. Haessler.

Lijo Pavia, J. and Brage, D. **Retinitis pigmentosa and familial macular degeneration.** Rev. oto-neuro-oftal. **21**:76-82, June-Aug., 1956.

The authors present the genealogical trees of three families with retinitis pigmentosa and familial macular degeneration and nystagmus and with congenital word blindness and deafness.

The paper has to be read in the original. The graphic presentation of the interrelation among the three families is the key to the understanding why the authors feel that all three of the diseases mentioned are recessive characters. (1 figure, 1 table, 5 references)

Walter Mayer.

Moro, F. and Ruol, A. **A case of Laurence-Moon-Bardet-Biedl syndrome with cerebral abnormality and persistance of remanants of the hyaloid artery.** Riv. oto.-neuro-oftal. **31**:104-128, March-April, 1956.

The authors present a detailed discussion of the Laurence-Moon-Bardet-Biedl syndrome. The findings in a 16-year-old girl are presented in detail. The classical findings were present in this patient. In addition pneumoencephalography revealed a slight reduction in the total volume of the brain together with a relative retinal arterial hypertension. The exact significance of a persistent hyaloid artery in this patient remains in doubt. (5 figures, 78 refernces)

William C. Caccamise.

Sjoegren, Torsten. **Oligophrenia combined with congenital ichthyosiform erythrodermia, spastic syndrome and macular-retinal degeneration.** Acta Genet. & Stat. Med. **6**:80-91, 1956.

The author describes a syndrome of idiocy, xeroderma, pyramidal tract signs and in two cases a macular degeneration. The total group consists of 25 cases in 10 families. Fifteen of the 25 are dead, and detailed investigations are under way on the remaining 10. The author describes two of these in detail. Because of the high rate of consanguineous marriage in this group the author feels that he is dealing with a specific recessive gene associated with a specific clinical entity. (1 figure, 2 tables, 6 references)

David Shoch.

Waardenburg, P. J. **Intermarriages of hereditarily deaf mute and of hereditarily**

blind people, marriage counselling and the question of sterilization. Acta Genet. & Stat. Med. **6**:113-121, 1956.

The author was consulted by a young woman, a deaf mute who wished to marry a deaf mute. In the course of examination it was found that the young woman also had retinitis pigmentosa. Although a complete pedigree is not given, the author felt that these congenital anomalies were inherited in a recessive-autosomal manner, and he therefore encouraged the marriage, warning against marriage of their progeny to other blood relatives. From this case the author proceeds to a sketchy discussion of modes of inheritance, illustrating each with a pertinent case. He wisely counsels complete genetic investigation for all people with congenital ocular anomalies. (14 references)

David Shoch.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Appelmans, M., Zwigsen, J., Missotten, L. and Raoult, J. **Studies on fusion ability for professions requiring high visual skill.** Bull. Soc. belge d'opht. **112**:236-250, March, 1956.

The authors made a survey of the difficulties in the evaluation of binocular vision, aptitude of visual performance and potential visual capacity of individual workers in different modern industries requiring especially high visual tasks. The tests, instruments and methods used are described and the results are summarized and recorded in statistical tables. It is emphasized that the results of tests on binocular vision vary with different tests and that simple tests, especially selected for individual professions and circumstances often give more practical and satisfactory information for the employee and the employer than elaborate scientific equipment. (3 figures, 1 table, 17 references) Alice R. Deutsch.

Biernacka-Biesiekierska, Jadwiga. **Medical expert evaluation in ophthalmology.** Klinika Oczna **26**:83-92, 1956.

The author presents charts with classification of eye disabilities. Various eye diseases are divided according to the degree of disability. Articles of the decree of the Ministry of Labor explaining different points of the classification are given. A chart grouping different occupations according to their visual requirements completes the paper.

Sylvan Brandon.

Dressler, A. **Fluorescent lighting and its effects on the eye.** Tr. Ophth. Soc. Australia **15**:87-94, 1955.

Fluorescent lights do not emit any harmful amounts of ultra-violet radiation. Refraction of the eye is slightly different under fluorescent light than in daylight. Most complaints about fluorescent lighting are either pychologic or due to faulty installations. The two most frequently encountered faults are excessive discomfort, glare, and the presence of reflected glare. (1 figure, 2 tables, 4 references)

Ronald F. Lowe.

Mann, Ida. **Ophthalmic surveys in Australia.** Tr. Ophth. Soc. Australia **15**:9-19, 1955.

The plan of ophthalmic survey of population in Australia between parallels 35° and 8° south is described. The most important clinical condition is trachoma which appears to have been imported during the eighteenth and nineteenth centuries. Arrow injuries in New Guinea natives and injuries from sticks in Australian aborigines account for most monocular blindness, yet from 367 severe eye injuries examined no case of sympathetic ophthalmia was found. Senile cataract and glaucoma were uncommon. Convergent strabismus was very rare among natives compared with the whites. Defective colour vision was found in 7.3 percent

of white males and 1.9 percent of full-blood aborigines. The need for improvement in hygiene, and the need for treatment of infections is stressed. An anti-trachoma campaign has already been started in the Kimberleys. (6 tables)

Ronald F. Lowe.

Mann, I. and Loschdorfer, J. **Ophthalmic survey of the territories of Papua and New Guinea, 1955.** Health Department. Territory of Papua and New Guinea. Port Moresby. pp. 53.

This interesting monograph describes a survey of representative native groups throughout the mainland and neighboring islands of the Australian Territories of Papua and New Guinea. The investigations took place between November, 1954 and March, 1955. The objectives were to discover not only the ophthalmic diseases present but particularly to investigate the distribution and severity of trachoma, to try to determine whether the Australian mainland aboriginals had received their trachoma infection from the Orient via adjacent islands or whether infection had been brought by the early settlers.

Trachoma was found in 53 percent of the natives examined. It is not indigenous but has been brought in by outside contacts and is being spread by the movement of persons from the coast to the inland (especially by recruited native laborers returning to their villages). The Australian aboriginal received trachoma through European or Asiatic contacts and not in the course of his original migration, or from New Guinea. Trachoma is a mild, self-limiting disease which tends to become serious when secondarily infected. The type encountered was not severe, except in New Britain. Europeans contract the same mild type of trachoma as the natives. (13 figures, 2 maps, 45 tables)

Ronald F. Lowe.

Orlowski, Witold J. **Polish ophthalmological bibliographies of 1954.** Klinika Oczna **26**:95-96, 1956.

The author cites the titles of 78 papers on ophthalmological subjects which appeared in Polish Medical Periodicals in 1954, except Klinika Oczna.

Sylvan Brandon.

Tower, Paul. **Notes on the life and work of George Bartisch.** A.M.A. Arch. Ophth. **56**:57-70, July, 1956.

In this interesting article on sixteenth century European medicine, Tower describes procedures for strabismus, blepharophimosis, cataract, malignancy and inflammatory disease. (8 figures, 17 references)

G. S. Tyner.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 12th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. John Wallace Beil, Kansas City, Missouri, died September 22, 1956, aged 81 years.

Dr. Lyn Waller Deichler, Philadelphia, Pennsylvania died October 2, 1956, aged 74 years.

Dr. Leonard Fox, Wyandotte, Michigan, died October 7, 1956, aged 33 years.

Dr. Milton Tacitus Gaillard, Baldwin, New York, died October 19, 1956, aged 52 years.

ANNOUNCEMENTS

OXFORD CONGRESS

The Oxford Ophthalmological Congress will hold its 42nd annual meeting at Balliol College, Broad Street, Oxford, England, on June 30, and July 1, 2, and 3, 1957. On Monday morning, there will be a discussion on "The facial neuralgias," with Mr. E. F. King, London, Dr. W. Ritchie Rusell, Oxford, and Mr. G. F. Rowbotham, Newcastle, as introducers. The second discussion on Wednesday morning will be opened by Dr. Dorothy R. Campbell, Coventry, Prof. W. J. B. Riddell, Glasgow, and Mr. T. S. Drake, principal, America Lodge, Torquay. It will be on "The rehabilitation of the blind and partially sighted patient.

Members wishing to contribute to these discussions are requested to send their names to the honorary secretary, Ian C. Fraser, 21 Dogpole, Shrewsbury. The Doyne Memorial Lecture will be delivered on Tuesday morning by Dr. Derrick Vail, Chicago. Ophthalmologists not already members of the congress who wish to attend the meetings should communicate with the honorary secretary who will send application forms for membership on request.

WALTER REED POSTGRADUATE COURSE

Ophthalmologists from across the country have been invited to attend the Third Biennial Postgraduate Course in Ophthalmology at Walter Reed Army Medical Center, Washington, D.C., March 18th to 20th. From 3,000 to 4,000 leaders in the field are expected to participate in the program which is being held in conjunction with the sectional meeting of the American College of Surgeons.

Topics to be covered in the postgraduate course range from corneal transplantation to glaucoma to cataract surgery. Papers reflecting the latest concepts in diagnosis, treatment, and care of patients will be delivered.

Members of the Walter Reed staff who will lecture during the sessions are Col Francis W. Pruitt, chief of the Department of Medicine; Dr. Frank B. Walsh and Dr. G. Victor Simpson, Walter Reed consultants; Lt. Col. George J. Hayes, chief of the Neurosurgery Service; and Dr. James A. Stokes and Dr. John R. Weimer, senior residents in ophthalmology. Speakers will also include Dr. Lorenz E. Zimmerman and Lt. Col. Raymond A. Skeehan, Jr., of the Ophthalmic Pathology Section of the Armed Forces Institute of Pathology.

Other doctors on the program will be Trygve Gundersen, Byron Smith, Ramon Castroviejo, Charles Iliff, Merrill J. Reeh, Marshall M. Parks, Arthur J. Jampolsky, Ludwig von Sallmann, Francis Heed Adler, Harold G. Scheie, Paul A. Chandler, Joseph S. Haas, Kenneth E. Hudson, A. Edward Maumenee, Derrick Vail, Harvey E. Thorpe, Joseph Wadsworth, Irving Leopold, John S. McGavic, Charles L. Schepens, James O'Rourke, and Benjamin Rones.

MISCELLANEOUS

FLORIDA PROGRAM

On the ophthalmology program of the 11th annual University of Florida Midwinter Seminar in Ophthalmology and Otolaryngology were:

Dr. Algernon B. Reese, New York, who spoke on "Diagnosis and treatment of ocular tumors" and "Ocular diseases of infancy and childhood"; Dr. Harold W. Brown, New York, "Methods of analysis of ocular motility," "Congenital structural anomalies of the extraocular muscles," and "Surgical management of the convergent deviations"; Dr. Irving H. Leopold, Philadelphia, "Present status of the diagnosis and therapy of uveitis," "Recent advances in the medical therapy of glaucoma," and "The therapy of vascular lesions of the fundus"; Dr. Francis Heed Adler, Philadelphia, "Comitant esotropia," "Intermittent exotropia," and "The analysis of congenital oculomotor paralyses"; Dr. Cecil W. Lepard, Detroit, "Orbital tumors in infancy and childhood," "Developmental cataracts," and "The diagnosis and treatment of strabismus before the age of two."

FIGHT FOR SIGHT GRANTS COMMITTEE

The National Council to Combat Blindness, Inc., 30 Central Park South, New York 19, New York, in accordance with its program concerned with the financing of research in ophthalmology and its related sciences announces that applications for its 1957-58 Fight for Sight Grant-in-Aid and Fellowship awards will be considered at the eighth annual meeting of the organization's Scientific Advisory Committee to be held in the spring of 1957. This committee has been enlarged to 19. and its mem-

bers are: Chairman, Dr. Charles A. Perera, New York, Dr. James H. Allen, New Orleans, Dr. Bernard Becker, Saint Louis, Dr. Alson E. Braley, Iowa City, Frederick Crescitelli, Ph.D., San Francisco, Dr. Arthur G. DeVoe, New York Dr. Dan M. Gordon, New York, Charles Haig, Ph.D., New York, Dr. Michael J. Hogan, San Francisco, Dr. Peter C. Kronfeld, Chicago, Dr. Irving H. Leopold, Philadelphia, Dr. A. E. Maumenee, Baltimore, Dr. Karl Meyer, New York, Dr. Stuart Mudd, Philadelphia, Lorrin A. Riggs, Ph.D., Brown University, T. C. Ruch, Ph.D., University of Washington, Dr. Samuel L. Saltzman, New York, Dr. Kenneth C. Swan, Portland, and Dr. Phillips Thygeson, San Francisco.

The closing date for receipt of completed applications for Grant-in-Aid and Fellowship awards is April 15, 1957.

Applications for Summer Student Fellowships will be reviewed in advance of the meeting, and such applications should be filed with the office of the organization no later than April 1, 1957.

All applicants for fellowships are required to make their own arrangements for suitable research facilities with accredited institutions.

Appropriate forms may be obtained by addressing:

Secretary,
National Council to Combat Blindness, Inc.,
30 Central Park South,
New York 19, New York.

Fight for Sight awards

The 1956-1957 Fight for Sight awards of the National Council to Combat Blindness, Inc., are:

Grants-in-aid. Endre A. Balacz, M.D., Retina Foundation, Boston, $2,500.00, "Studies on the cortical layers of the vitreous body: With special regard to its mucopolysaccharides content"; Goodwin M. Breinin, M.D., New York University—Bellevue Medical Center, $4,000.00, "Electromyography of the extraocular muscles including stimulation studies and evaluation of drug effects on the action currents"; Robert Brunish, Ph.D., University of California at Los Angeles, $842.00, "Hyaluronic acid and hyaluronidase in ocular tissue"; Max Chamlin, M.D., Albert Einstein College of Medicine, Yeshiva University, New York, $1,200.00, "Development of equipment and a method for the determination of a previously unused isopter in the intermediate field of vision, and the determination of this isopter in normal subjects," and $1,200.00, "Size of the normal blindspot: Physiological variations and variations due to techniques used in measurement"; Paul Anton Cibis, M.D., Washington University, Saint Louis, $4,000.00, "Histopathology of the eye with oblique illumination."

Bruce Edmond Cohan, M.D., University of Chicago Clinics, Chicago, $450.00, "Outflow of aqueous humor: An experimental study using radio-opaque materials"; Robert S. Coles, M.D., New York University Bellevue Medical Center, $1,026.00, "The evaluation of antistreptolysin titers in patients with uveitis" (part of a comprehensive program for the study of this disease at New York University—Bellevue Medical Center); Levon K. Garron, M.D., University of California, San Francisco, $4,400.00, "Special histopathologic study of endogenous uveitis"; Harry Green, Ph.D., Wills Eye Hospital, Philadelphia, $5,700.00, "Intraocular pressure and the bicarbonate ion concentration in animal eyes"; Dan M. Gordon, M.D., New York Hospital—Cornell Medical Center, New York, $3,150.00, "Application of visual aids in patients with subnormal vision"; John E. Harris, M.D., University of Oregon Medical School, Portland, $4,500.00, "Excretion of melanocyte-stimulating hormone in patients with certain ocular diseases"; Jerry Hart Jacobson, M.D., New York Eye and Ear Infirmary, New York, $4,500.00 "Electroretinography in retinal disease: Electrophysiology of the eye"; P. J. Leinfelder, M.D., University Hospitals, Iowa City, Iowa, $1,485.00, "The effect of change of pH in the aqueous on metabolism of the lens and cornea."

I. C. Michaelson, M.D., Hadassah University Hospital, Jerusalem, Israel, $1,235.00, "I. Factors affecting new vessel growth in the cornea," II. Changes in hyaluronic acid content of vitreous in physiologic and pathologic conditions"; Yukihiko Mitsui, M.D., Kumamoto University Medical School, Kumamotoshi, Japan, $600.00, "Study of trachoma virus by cultivation and electron microscopy"; Burton M. Pogell, Ph.D., Wilmer Ophthalmological Institute, Baltimore, $4,800.00, "Metabolism and turnover of mucopolysaccharides in cornea and lens"; Magin Puig Solanes, M.D., Mexico, D.F., $2,400.00, "Comparative anatomic and physiologic study of the structures related to the maintenance of intraocular pressures in Mexican Indians, 'mestizos', and white people"; Jun Tsutsui, M.D., Okayama University Medical School, Okayama-shi, Japan, $1,000.00 "Clinical and virologic studies on trachoma; especially immunity spontaneous cure and tumorlike nature of the infected tissues"; Jerome J. Wolken, Ph.D., University of Pittsburgh, Eye and Ear Hospital, Pittsburgh, $2,600.00, "Photoreceptor structures"; William C. Frayer, M.D., and Francis Heed Adler, M.D., University of Pennsylvania, Philadelphia, $3,000.00, "A study of the factors involved in the proliferation of the retinal pigment epithelium in disease"; Louise L. Sloan, Ph.D., Wilmer Institute, Baltimore, $500.00, "Evaluation of reading aids for patients with subnormal vision"; Edgar Auerbach, M.D., Hadassah University Hospital, Jerusalem, Israel, $5,000.00, "Light and color perception."

Research fellowships. Albert B. Chatzinoff, M.D., (supervisor, Frederick Theodore, M.D.), Mt. Sinai Hospital, New York, $1,500.00, "Chronic deficiency of 11-cis vitamin A as the possible etiology of retinitis pigmentosa"; Anthony Donn, M.D., (supervisor, David Maurice, M.D.), Institute of Ophthalmology, London, $4,000.00, "The active transport of ions across the corneal epithelium and endothelium"; Tibor George Farkas, (supervisor,

Normand L. Hoerr, M.D.), Western Reserve University, Cleveland, $3,000.00, "Role of insulin in the metabolism of the lens"; Harding Ernest Bishop, (supervisor, Prof. Isidore Gersh), University of Chicago, Chicago, $2,400.00, "Retinal ultrastructure and possible functional changes in retinal ultrastructure"; John A. Pratt-Johnson, M.D., (supervisor, A. E. Maumenee, M.D.), Wilmer Eye Institute, Baltimore, $3,600.00, "Corneal transplantation with particular reference to elimination of the delayed sensitivity reaction as a result of homotransplantation," and "The metabolism and turnover of mucopolysaccharides in cornea and lens" and "Other chemical and allergic reactions which take place in the recipient's eye."

Student research fellowships.

Irwin Willard Abrahams, (supervisor, Antonio Fernando, M.D.), New York University-Post-Graduate Medical School, New York, $500.00, "A study of radioactive labelled antigens in experimental uveitis"; Boris Andrst, (supervisor, George N. Wise, M.D.), New York University-Bellevue Medical School, New York, $600.00, "Pathogenesis of retinal microaneurysms"; Leslie Allan Bard, (supervisor, Burton Pogell, M.D.), Wilmer Institute, Baltimore, $600.00, "Possible intermediates in the corneal synthesis of mucopolysaccharides"; Arthur Berken, (supervisor, Bernard Becker, M.D.), Washington University School of Medicine, Saint Louis, $600.00, "The study of retinal and renal capillaries"; Robert Emmet Moran, Jr., (supervisor, A. E. Maumenee, M.D.), Wilmer Institute, Baltimore, $600.00, "Corneal transplantation with particular reference to elimination of the delayed sensitivity reaction as a result of homotransplantation"; Richard B. Oglesby, (supervisor, Bernard Becker, M.D.), Washington University School of Medicine, Saint Louis, $600.00, "The effect of trauma on aqueous flow"; Melvin Lynne Rubin, University of California Medical School, San Francisco, $600.00, "The antitoxoplasmic activity of three chemotherapeutic agents"; Ernest H. Shin, (supervisor, J. J. Wolken, Ph.D.), University Medical Center, Pittsburgh, $450.00, "Kinetic studies related to bleaching of visual and photosynthetic pigments"; Lawrence Isom, (supervisor, William K. McEwen, Ph.D.), University of California School of Medicine, San Francisco, $400.00, "Production and measurement of experimental glaucoma in monkeys."

Societies

Kansas City meeting

On the January program of the Kansas City Society of Ophthalmology and Otolaryngology were:

Dr. Byron Smith, New York, the guest speaker, who discussed "Preferred techniques in ophthalmic plastic surgery," and presented the Curran Lecture on "Thermal burns of the eyelids." Other papers were presented by Dr. Stanley McEwen, Dr. Charles Crockett, and Dr. James T. Robison.

Milwaukee officers

Serving as officers for the Milwaukee Oto-Ophthalmic Society during 1957 are: President, Dr. Howard V. Morter; vice-president, Dr. E. Franklin Carl; secretary, Dr. Lawrence L. Garner.

Personals

Dr. Irving H. Leopold, Philadelphia, delivered the 10th annual Schoenberg Memorial Lecture of the New York Society for Clinical Ophthalmology and the National Society for the Prevention of Blindness on Monday, December 10th, at 8:00 P.M. at Hosack Hall, New York Academy of Medicine, New York, Dr. Leopold's subject was "Recent advances in the medical therapy of glaucoma."

At the same meeting, Dr. Hans Goldmann of the University of Berne, Switzerland, spoke on "The problem of glaucoma in myopia."

Dr. Theodore I. Fischer-Galati, now at 131 Main Street, Andover, Massachusetts, celebrated on December 31, 1956, his 75th birthday, and also his golden anniversary as a member of the research staff of the First Eye Clinic in Vienna under Prof. Schnabel.

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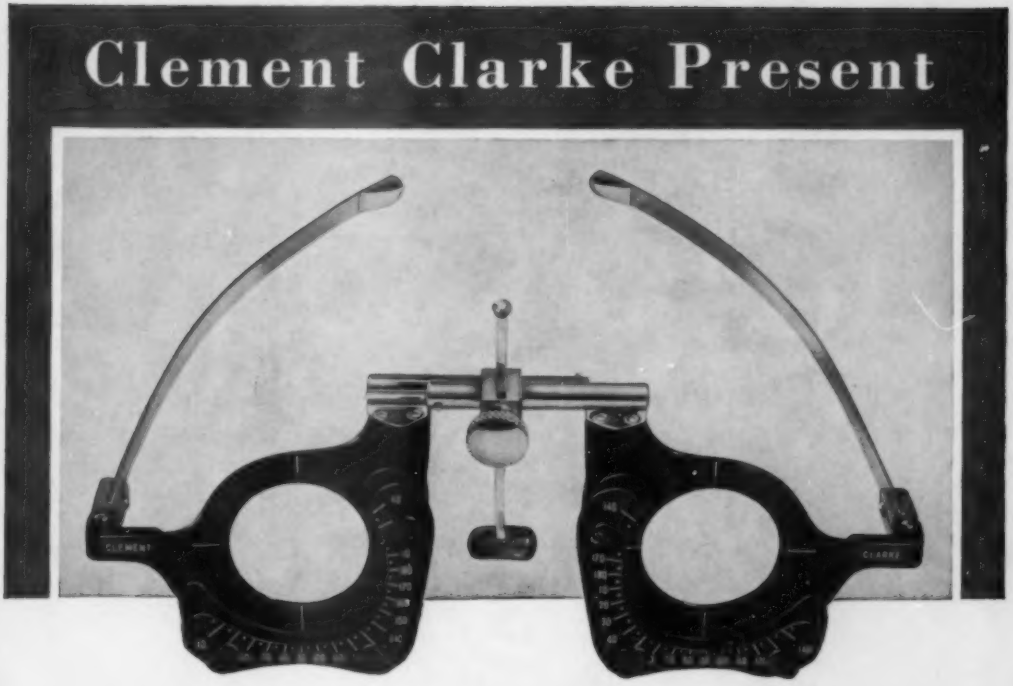

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